

(19) 日本国特許庁 (J P)

(12) 公開特許公報 (A)

(11) 特許出願公開番号  
特開2002-50450  
(P2002-50450A)

(43) 公開日 平成14年2月15日 (2002.2.15)

(51) Int.Cl. <sup>7</sup>	識別記号	F I	テマコード <sup>*</sup> (参考)
H 0 5 B 3/00	3 1 0	H 0 5 B 3/00	3 1 0 E 2 H 0 3 3
	3 3 5		3 3 5 3 K 0 5 8
G 0 3 G 15/20	1 0 9	G 0 3 G 15/20	1 0 9 5 H 3 2 3
G 0 5 D 23/24		G 0 5 D 23/24	M 5 H 4 2 0
G 0 5 F 1/45		G 0 5 F 1/45	B

審査請求 未請求 請求項の数6 O L (全 12 頁) 最終頁に続く

(21) 出願番号 特願2000-237162(P2000-237162)

(22) 出願日 平成12年8月4日(2000.8.4)

(71) 出願人 000001007

キヤノン株式会社

東京都大田区下丸子3丁目30番2号

(72) 発明者 西田 義昭

東京都三鷹市下連雀6丁目3番3号 コピ  
ア株式会社内

最終頁に続く

(54) 【発明の名称】 ヒータ制御方法および画像形成装置

(57) 【要約】

【課題】 2値制御とは異なる多値制御により、温度調整中によりきめ細かな温度制御を行うとともに電流変動（フリッカ値）を低減する。

【解決手段】 ヒータの加熱対象の温度を、3つの閾値  $T_a$ 、 $t_b$ 、 $t_c$  で分割された4つの温度範囲に分割する。一方、交流電源電圧の連続する3半波長分を周期とした通電パターンであって、半波の間引きの無い第1の通電パターン、1半波を間引く第2の通電パターン、2半波を間引く第3の通電パターン、および通電無しの第4の通電パターンを用意し、これらをそれぞれ温度の低い側から前記4つの温度範囲に割り当てる。ヒータ温度調整の制御時には、逐次、ヒータの加熱対象の温度を検出し、この検出された温度が前記4つの温度範囲のうちのどの温度範囲に属するかを判定する。その属する温度範囲に対応する通電パターンでヒータを制御する。

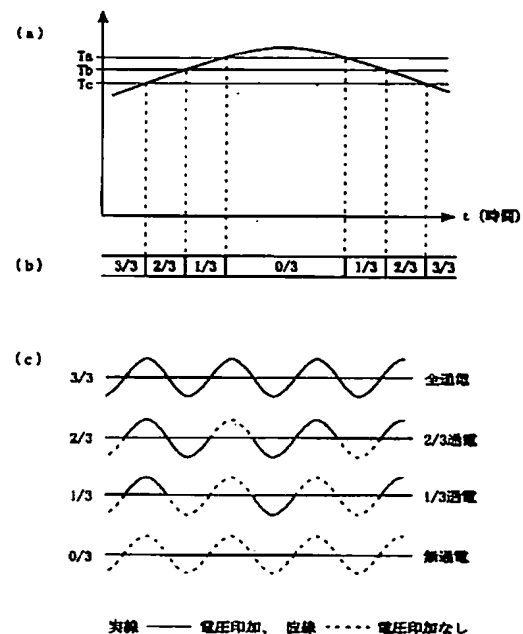


図5

## 【特許請求の範囲】

【請求項 1】 交流電源によりヒータを駆動する際のヒータ制御方法であって、

逐次、ヒータの加熱対象の温度を検出するステップと、この検出された温度が、3つの閾値で分割された4つの温度範囲のうちのどの温度範囲に属するかを判定するステップと、

電源電圧の連続する3半波長分を周期とした通電パターンであって、半波の間引きの無い第1の通電パターン、1半波を間引く第2の通電パターン、2半波を間引く第3の通電パターン、および通電無しの第4の通電パターンを、それぞれ温度の低い側から前記4つの温度範囲に割り当て、前記判定された温度範囲に割り当てられた通電パターンで前記ヒータを制御するステップと、を備えたことを特徴とするヒータ制御方法。

【請求項 2】 前記第2、第3および第4の通電パターンの少なくとも1つによる前記ヒータの制御は、前記加熱対象の温度を考慮することなく、少なくとも1周期より長い予め定めた時間継続させることを特徴とする請求項1記載のヒータ制御方法。

【請求項 3】 請求項1または2に記載のヒータ制御方法であって、第2の通電パターンから第1の通電パターンへ移行させる温度閾値を $T_a$ 、第3の通電パターンから第2の通電パターンへ移行させる温度閾値を $T_b$ 、第4の通電パターンから第3の通電パターンへ移行させる温度閾値を $T_c$ としたとき、これらの温度閾値の関係を、 $T_a > T_b > T_c$

とするとともに、

逆に、第1の通電パターンから第2の通電パターンへ移行させる温度閾値を $T_a'$ 、第2の通電パターンから第3の通電パターンへ移行させる温度閾値を $T_b'$ 、第3の通電パターンから第4の通電パターンへ移行させる温度閾値を $T_c'$ としたとき、

$T_a \geq T_a'$

$T_b \geq T_b'$

$T_c \geq T_c'$

(ただし、この3つの式全てを等号とする条件は除く)の関係としたことを特徴とするヒータ制御方法。

【請求項 4】 交流電源によりヒータを駆動する際のヒータ制御方法であって、

逐次、ヒータの加熱対象の温度を検出するステップと、この検出された温度が、6つの閾値で分割された7つの温度範囲のうちのどの温度範囲に属するかを判定するステップと、

電源電圧の連続する3半波長分を周期とした通電パターンであって、半波の間引きの無い第1の通電パターン、1半波を間引く第2の通電パターン、2半波を間引く第3の通電パターン、および通電無しの第4の通電パターンのうち、第1の通電パターンと第1の通電パターンとを組み合わせた第1の組合せ通電パターン、第2の通電

パターンと第1の通電パターンとを組み合わせた第2の組合せ通電パターン、第2の通電パターンと第2の通電パターンとを組み合わせた第3の組合せ通電パターン、第3の通電パターンと第2の通電パターンとを組み合わせた第4の組合せ通電パターン、第3の通電パターンと第3の通電パターンとを組み合わせた第5の組合せ通電パターン、第4の通電パターンと第3の通電パターンとを組み合わせた第6の組合せ通電パターン、第4の通電パターンと第4の通電パターンとを組み合わせた第7の組合せ通電パターンを、それぞれ温度の低い側から前記7つの温度範囲に割り当て、前記判定された温度範囲に割り当てられた組合せ通電パターンで前記ヒータを制御するステップと、

を備えたことを特徴とするヒータ制御方法。

【請求項 5】 交流電源によりヒータを駆動する際のヒータ制御方法であって、

逐次、ヒータの加熱対象の温度を検出するステップと、この検出された温度が、 $(n-1)$ 個の閾値で分割された $n$ 個 ( $n$ は3以上の整数)の温度範囲のうちのどの温度範囲に属するかを判定するステップと、

電源電圧の連続する $m$ 半波長分 ( $m$ は3以上の奇数)を周期とした1または複数の通電パターンを単位通電パターンとして、半波の間引き数の順次大となる第1から第 $n$ の単位通電パターンを、それぞれ温度の低い側から前記 $n$ 個の温度範囲に割り当て、前記判定された温度範囲に割り当てられた通電パターンで前記ヒータを通電するステップと、

を備えたことを特徴とするヒータ制御方法。

【請求項 6】 トナー像を用紙上に定着させる定着装置を有する画像形成装置であって、

前記定着装置に内蔵される定着ヒータと、

このヒータに対する交流電源電圧の印加を制御するスイッチング手段と、

前記定着ヒータの温度を検出する温度検出手段と、

前記温度検出手段により検出された温度が、 $(n-1)$ 個の閾値で分割された $n$ 個 ( $n$ は3以上の整数)の温度範囲のうちのどの温度範囲に属するかを判定する手段と、

電源電圧の連続する $m$ 半波長分 ( $m$ は3以上の奇数)を周期とした1または複数の通電パターンを単位通電パターンとして、半波の間引き数の順次大となる第1から第 $n$ の単位通電パターンを、それぞれ温度の低い側から前記 $n$ 個の温度範囲に割り当て、前記判定された温度範囲に割り当てられた通電パターンで前記スイッチング手段を制御する制御手段と、を備えたことを特徴とする画像形成装置。

## 【発明の詳細な説明】

## 【0001】

【発明の属する技術分野】 本発明は、主として、静電式複写機、プリンタ等の画像形成装置に内蔵される定着装

置のヒータ制御に関し、特に、温度調整のためのヒータの通電時の急激な電流変動を低減させることができるヒータ制御方法および画像形成装置に関する。

#### 【0002】

【従来の技術】従来、この種のヒータには、比較的消費電流の大きいハロゲンランプが使用されており、そのON時には突入電流などの大きな電流変動が発生する。

【0003】図1は、定着ローラの概略図を示す。定着ローラは、ヒータ4を内蔵するヒータローラ1と、このヒータローラ1に対して加圧される加圧ローラ2とを有する。この両ローラ1、2間に用紙3を通過させることにより、用紙3上に現像されたトナー画像を用紙3上に熱融着させる。

【0004】図2は、ヒータローラ1の温度調整のための従来のON/OFF制御時のヒータ通電電流波形を示す。この波形において、P1、P2部が、ヒータのOFF状態、ON状態の切り替わり時点に対応する急激な電流変化部分である。この電流変動が、供給電源そのものの電圧変動を生じさせ、同一電源に接続されている照明等のチラツキを引き起こしてきた。すなわち、図4に示すように、一般的に、電源コンセントの外側から供給電源ACを見た場合、比較的小さな電源インピーダンスRsが存在する。このため、電源ACへの接続機器（ここでは、複写機）Dの消費電流が大きく急に変化したときは、電源インピーダンスRsによる電圧降下に起因して、電源電圧の変動が発生する。急激な電流変化を $\Delta I$ とすれば、急激な電源電圧変動分 $\Delta V$ は、次式で表される。

$$\Delta V = R_s \times \Delta I$$

例えば、このコンセントラインに照明器具Lが接続されていれば、急激な電源電圧変動は照明のチラツキとなって現れてくる。近年、このような機器の急激な電流変化による電源電圧変動を低減させようとする要請が強まっている。

#### 【0006】

【発明が解決しようとする課題】このような、照明器具のチラツキを防止するには、電流変化を緩やかにする必要がある。すなわち、複写機等の定着装置に使用されるハロゲンヒータによる急激な電流変化を低減する必要がある。（このことを、本明細書では「フリッカ値の低減」ともいう。）具体的には、図2内に示されたハロゲンヒータ通電電流ON時のP1、OFF時のP2部の急激な電流変化部分を緩和することが必要である。

【0007】この問題点を解決するための方法は、図3に示すような位相制御（導通角制御）によるヒータへの通電である。既に述べたように、ヒータON直後の突入電流発生時のような急激な電流変化を防止するには、実効的に印加電圧を徐々に大きくしていけばよく、例えば図3のヒータ通電電流波形に示した形で、まず、交流電源電圧の各半波長内の通電時間を、初めは小さくし、徐

々に大きくしていく（ $t_1$ ,  $t_2$ ,  $t_3$ , ...  $t_n$ ）。

【0008】この方法は周知であり、事実理想に近い穏やかな電流変化をさせることも可能である。しかし、その方法には、以下のような欠点も存在する。1. 位相角を決めるためのタイマ機構など、そのハードウェアが複雑であり、それらの設定、起動などの制御上の複雑性も同様に高くなると考えられる。2. 電源周波数の異なる地域（50Hz, 60Hzの地域差）に対しては、各々別の設定が必要で、切り分け管理に対する煩雑さがある。3. 図3を見ても明らかなように、ヒータへの通電がゼロクロス起点ではなく、半波長内でONされているため、高調波電流が増大する。この電流は、電源周波数の高次波（数倍～数十倍）で発生する。これは給電線を通して接続された他の機器へノイズとして妨害を与え、誤動作や故障の原因となる。従って、位相制御の場合には、この高調波電流を低減するため、別途、大容量のチョークコイルを挿入する等の対応が必要となっている。

【0009】位相制御によるもの以外では、特開平9-80961号公報に、ヒータのONタイミングとOFFタイミングとの少なくともONタイミングから所定時間は交流連続点灯による定格の通電電力より少ない電力になるような交流不連続パターンによりゼロクロス点灯をするようにヒータに電力を供給する技術が開示されている。また、特開平11-95611号公報には、2本のヒータを備える定着装置におけるゼロクロス点灯の技術が開示されている。これらにより、ヒータON時の突入電流を低減し、ノイズの発生を低減することができる。

【0010】通常、定着装置では、ヒータローラの温度を所定温度に維持するために、継続的な温度調整が行われている。この所定の温度は、コピー時や待機時等の動作モードによって異なりうるが、いずれにせよ、ヒータのON/OFFは、ヒータローラの温度を所定値（閾値）と比較することにより行われる。すなわち、温度が所定値より低下したらヒータのON信号を出力し、所定値を超えたらヒータのOFF信号を出力するものである。温度上昇時と下降時の閾値を異ならせる（すなわちヒステリシスをもたせる）ことはあるが、いずれにせよ、従来のヒータ制御は原則的には2値制御である。

【0011】これに対して、本発明は、温度調整中によりきめ細かな温度制御を行うとともに電流変動（フリッカ値）を低減することができる新規なヒータ制御方法および画像形成装置を提供することを目的とする。

#### 【0012】

【課題を解決するための手段】上記目的を達成するために、本発明によるヒータ制御方法は、交流電源によりヒータを駆動する際のヒータ制御方法であって、逐次、ヒータの加熱対象の温度を検出するステップと、この検出された温度が、3つの閾値で分割された4つの温度範囲のうちのどの温度範囲に属するかを判定するステップ

と、電源電圧の連続する 3 半波長分を周期とした通電パターンであって、半波の間引きの無い第 1 の通電パターン、1 半波の間引く第 2 の通電パターン、2 半波の間引く第 3 の通電パターン、および通電無しの第 4 の通電パターンを、それぞれ温度の低い側から前記 4 つの温度範囲に割り当て、前記判定された温度範囲に割り当てられた通電パターンで前記ヒータを制御するステップとを備えたことを特徴とする。

【0013】このように、ヒータの加熱対象の温度範囲を 4 つの分割し、各温度範囲に対して 4 つの異なる通電パターン (4 値) を割り当てることにより、従来の ON/OFF 2 値の制御に比べて高精度な温度制御を行うことが可能となるとともに、電流変動の低減によるフリッカ値の低減も達成できる。

【0014】このヒータ制御方法において、好ましくは、前記第 2、第 3 および第 4 の通電パターンの少なくとも 1 つによる前記ヒータの制御は、前記加熱対象の温度を考慮することなく、少なくとも 1 周期より長い予め定めた時間継続させる。これによって、このような時間継続を行わない場合に比べてフリッカ値をさらに低減することができる。

【0015】上記ヒータ制御方法において、第 2 の通電パターンから第 1 の通電パターンへ移行させる温度閾値を  $T_a$ 、第 3 の通電パターンから第 2 の通電パターンへ移行させる温度閾値を  $T_b$ 、第 4 の通電パターンから第 3 の通電パターンへ移行させる温度閾値を  $T_c$  としたとき、これらの温度閾値の関係を、

【0016】 $T_a > T_b > T_c$

とするとともに、

【0017】逆に、第 1 の通電パターンから第 2 の通電パターンへ移行させる温度閾値を  $T_a'$ 、第 2 の通電パターンから第 3 の通電パターンへ移行させる温度閾値を  $T_b'$ 、第 3 の通電パターンから第 4 の通電パターンへ移行させる温度閾値を  $T_c'$  としたとき、

【0018】 $T_a \geq T_a'$

$T_b \geq T_b'$

$T_c \geq T_c'$

(ただし、この 3 つの式全てを等号とする条件は除く) の関係とすることもできる。これは、すなわち、4 つの温度範囲の境界の閾値の少なくとも 1 つにいわゆるヒステリシスをもたせるものである。これもフリッカ値の低減に効果がある。

【0019】本発明による別のヒータ制御方法は、交流電源によりヒータを駆動する際のヒータ制御方法であって、逐次、ヒータの加熱対象の温度を検出するステップと、この検出された温度が、6 つの閾値で分割された 7 つの温度範囲のうちのどの温度範囲に属するかを判定するステップと、電源電圧の連続する 3 半波長分を周期とした通電パターンであって、半波の間引きの無い第 1 の通電パターン、1 半波の間引く第 2 の通電パターン、2

半波の間引く第 3 の通電パターン、および通電無しの第 4 の通電パターンのうち、第 1 の通電パターンと第 1 の通電パターンとを組み合わせた第 1 の組合せ通電パターン、第 2 の通電パターンと第 1 の通電パターンとを組み合わせた第 2 の組合せ通電パターン、第 2 の通電パターンと第 2 の通電パターンとを組み合わせた第 3 の組合せ通電パターン、第 3 の通電パターンと第 2 の通電パターンとを組み合わせた第 4 の組合せ通電パターン、第 3 の通電パターンと第 3 の通電パターンとを組み合わせた第 5 の組合せ通電パターン、第 4 の通電パターンと第 3 の通電パターンとを組み合わせた第 6 の組合せ通電パターン、第 4 の通電パターンと第 4 の通電パターンとを組み合わせた第 7 の組合せ通電パターンを、それぞれ温度の低い側から前記 7 つの温度範囲に割り当て、前記判定された温度範囲に割り当てられた組合せ通電パターンで前記ヒータを制御するステップとを備えたことを特徴とする。これも別の多値制御の一例であり、上記のヒータ制御方法と同様の効果が得られる。

【0020】本発明によるヒータ制御方法は、別の観点によれば、交流電源によりヒータを駆動する際のヒータ制御方法であって、逐次、ヒータの加熱対象の温度を検出するステップと、この検出された温度が、 $(n-1)$  個の閾値で分割された  $n$  個 ( $n$  は 3 以上の整数) の温度範囲のうちのどの温度範囲に属するかを判定するステップと、電源電圧の連続する  $m$  半波長分 ( $m$  は 3 以上の奇数) を周期とした 1 または複数の通電パターンを単位通電パターンとして、半波の間引き数の順次大となる第 1 から第  $n$  の単位通電パターンを、それぞれ温度の低い側から前記  $n$  個の温度範囲に割り当て、前記判定された温度範囲に割り当てられた通電パターンで前記ヒータを通電するステップとを備えたことを特徴とする。

【0021】本発明のヒータ制御方法を実施するための装置は、トナー像を用紙上に定着させる定着装置を有する画像形成装置であって、前記定着装置に内蔵される定着ヒータと、このヒータに対する交流電源電圧の印加を制御するスイッチング手段と、前記定着ヒータの温度を検出する温度検出手段と、前記温度検出手段により検出された温度が、 $(n-1)$  個の閾値で分割された  $n$  個

( $n$  は 3 以上の整数) の温度範囲のうちのどの温度範囲に属するかを判定する手段と、電源電圧の連続する  $m$  半波長分 ( $m$  は 3 以上の奇数) を周期とした 1 または複数の通電パターンを単位通電パターンとして、半波の間引き数の順次大となる第 1 から第  $n$  の単位通電パターンを、それぞれ温度の低い側から前記  $n$  個の温度範囲に割り当て、前記判定された温度範囲に割り当てられた通電パターンで前記スイッチング手段を制御する制御手段とを備えたことを特徴とする。

【0022】

【発明の実施の形態】以下、本発明の好適な実施の形態について、詳細に説明する。

【0023】まず最初に、本発明の概念を説明する。本発明の方法は、従来のヒータON/OFF（2値）制御に対して制御精度をより高めることのできるヒータ制御方法を提供するものであり、これにより効果的にフリッカ値を低下させることができる。このヒータ制御方法を「多値比例制御」と呼ぶことにする。

【0024】1つの好適な実施の形態は、3半波長を1周期としこの1周期から異なる個数の半波を間引いて得られる4値（0、1/3、2/3、3/3）の通電パターンを用いる4値比例制御である。この制御では、図5（a）に示したように、4値を切り替える3つの境界温度値（閾値）を $T_a$ 、 $T_b$ 、 $T_c$ とし、これらの関係を $T_a > T_b > T_c$ に設定する。（例えば $T_b$ をはプリントまたはコピー時の目標温度とする。）これらの境界温度値で区画される4つの温度範囲に対して、図5（b）に示すように、それぞれ異なる間引き数の半波を間引いた1周期の印加電圧パターン（通電パターン）を割り当てる。仮に、温度が図5（a）に示すような変化をしたとすると、4値通電パターン（通電状態）は、順次、3/3→2/3→1/3→0/3→1/3→2/3→3/3というように変化することになる。図5（c）は、これらの4値の各々の通電パターンを示している。

【0025】なお、図5（a）は実際のヒータローラ1（図1）の温度変化を示すものではなく、4つの通電パターンとの対応関係を示すものである。とはいえ、ヒータローラ1の温度は比較的緩やかに変化するため、ヒータ4への電圧印加の変化は、段階的に（差分1/3ずつ）生じると考えてよい。従って、この方法により急激な電流変化の緩和がなされていると言える。

【0026】前記の基本的な4値比例制御を發展させ、より多値に分割した通電パターンを適用することも可能である。例えば、3半波長周期の2周期分をセットにした組合せ通電パターンを単位通電パターンとして用いる方法を、本発明の第2の実施の形態として図6に示す。この場合、6半波が単位通電パターンの1周期となる。

【0027】具体的には、次の7値の状態を示している。

（1）無通電（0/6）と（0/6）を組合わせた（0/6）組合せ通電パターン、（2）通電（1/3）と（0/3）を組合わせた（1/6）組合せ通電パターン、（3）通電（1/3）と（1/3）を組合わせた（2/6）組合せ通電パターン、（4）通電（2/3）と（1/3）を組合わせた（3/6）組合せ通電パターン、（5）通電（2/3）と（2/3）を組合わせた（4/6）組合せ通電パターン、（6）通電（3/3）と（2/3）を組合わせた（5/6）組合せ通電パターン、（7）通電（3/3）と（3/3）を組み合わせ、即ち全通電の（6/6）組合せ通電パターン。

【0028】このように3半波長周期の2周期分（6半波長分）を単位通電パターンとすれば、7値の比例制御

が可能となる。同様に、3半波長周期の3周期分（9半波長分）をセットパターンとすれば、10値の段階が得られる。更に周期を増すことで、より多値を得られることとなる。このような複数周期分（3半波長分の倍数分）を単位通電パターンとした形においても、各電流変化は、単なる全通電ON/OFFと比較すれば1/3となるため、ヒータ通電による急激な電流変化を減らす方向に働く。

【0029】更に考えを進めて、人間にとってチラツキを感じやすい周波数（8Hz付近）での電流変化を避ける方法を、本実施の形態の第1の変形例として、説明する。図5で説明した通電変化3/3→2/3→1/3→0→1/3→2/3→3/3の各状態への切り換え頻度を8Hz付近からもっと低域方向へ移すようにすればよい。すなわち、各通電パターンへの切り換え温度 $T_a$ と $T_b$ 、 $T_b$ と $T_c$ の差を所定値以上として各通電パターン（1/3）、（2/3）、（3/3）の各状態に滞留する時間（3半波長周期の数）を強制的に所定値以上となるように管理すれば、電流変化頻度を低下させ変化周波数をより低域へと移動させることができる。例えば、230V、800Wのハロゲンヒータについて、 $T_a = 186^\circ\text{C}$ 、 $T_b = 185^\circ\text{C}$ 、 $T_c = 184^\circ\text{C}$ とし、最小限の強制滞留時間（最低継続時間）を3半波長周期の1周期（3半波）から1周期毎に8周期（24半波）まで変化させた本発明者による実験では、フリッカメータにより測定されたフリッカ値（Pst）は、1.01から0.67まで順次低下した。ここに、Pst（Period Short Time）とは、EN61000-3-3の規格により定められた短時間（10分間）のフリッカ評価値であり、例えば、EMC 1995. 10. 5（No. 90）の第35頁～第41頁の「電圧変動とフリッカ測定」に記載されている。

【0030】但し、最低継続時間が長くなるほど、温度制御の応答性が悪くなり、ヒータローラの温度の変動が大きくなる。したがって、最低継続時間は2周期（6半波長）以上とすることが望ましいが、応答性も考慮すれば、4周期前後が好ましい。すなわち、最低継続時間が1周期である場合に比べて多少温度制御変動は大きくなっても、定着性を損なわない範囲に制限すれば一層フリッカ値を低減することができる。

【0031】なお、実際の通電状態の切り換え頻度は、上記最低継続時間で決まるものではなく、ヒータの熱履歴などの影響のため、最低継続時間で換算した周波数より低い周波数となる。

【0032】本実施の形態の第2の変形例として、 $T_a$ 、 $T_b$ 、 $T_c$ について温度ヒステリシスを持たせるやり方を考える。例えば、通電（1/3）から通電（0/3）に移行するときの温度閾値を $T_a$ 、同（2/3→1/3）の温度閾値を $T_b$ 、（3/3→2/3）の温度閾値を $T_c$ 、とし、これに対し逆方向の（0/3→1/3

3)の温度閾値を $Ta'$ 、 $(1/3 \rightarrow 2/3)$ の温度閾値を $Tb'$ 、 $(2/3 \rightarrow 3/3)$ の温度閾値を $Tc'$ 、と定める。このとき、

【0033】 $Ta \geq Ta'$ 、 $Tb \geq Tb'$ 、 $Tc \geq Tc'$

の関係とする(ただし、この3つの式全てを等号とする条件は除く)。

【0034】このようにして、各通電パターンの継続時間を持続し易いようにすることにより、変動頻度周波数を低域方向に移動させることができる。この第2の変形例は、第1の変形例と独立に採用することができるが、両変形例を併用することも可能である。また、両変形例は、共にまたは単独で、上記第2の実施の形態においても採用可能である。

【0035】以上の例では、すべて3半波長周期を基準とした。ここで、3半波長周期を基準に波数間引きを適用することの利点について簡単に説明する。例えば通電パターンの1周期を2半波長(サイン波形の1周期のこと)としてみれば、これから1半波長分間引くと半波整流波形と同じ直流成分となってしまうので、ハロゲンヒータの制御上問題が大きい。また、3半波長周期より長い周期での間引きは、照明等のチラツキの特性上、その間引き操作自体、人の目にチラツキとして感じ易くなる。従って、2半波長周期以外が一番短い周期、即ち3半波長周期で考えるのが妥当と言うことになる。事実、この3半波長周期の間引きにおいて、実際に照明を接続しチラツキを観測した所、チラツキ感は殆ど感じられなかった。

【0036】但し、5、7等の奇数の半波を基準周期とすることも可能である。このような場合、3半波長周期に比べればチラツキの点で効果は低下するとしても、電流変動の低減の効果はなお認められる。m半波長周期(mは3以上の奇数)の場合の温度閾値の個数は同数mとなる。

【0037】図7は、上述した本実施の形態の「波数制御」を実現するための制御回路の回路図である。

【0038】この図中のTHは、ヒータローラ(図1内1)の温度を検知するサーミスタ温度センサ(図1内5)である。このセンサTHは抵抗R1に接続され、その分圧電位は、中央処理装置CPU内のアナログ入力端子A/Dに入力されている。A/D端子に与えられた信号は、アナログ/デジタル変換され、CPU内で処理される。CPUの割込み入力端子INTには、電源電圧のゼロクロス点で発生したゼロクロスパルスが入力されている。このゼロクロスパルスの発生回路は、図7の上部のフォトカプラPCおよび比較器COM、抵抗R5~R10、ダイオードDにより構成されている。

【0039】ゼロクロスパルスの立下りに応じてCPU内部の割込みルーチン(後述)が起動され、このゼロクロス信号立下り直後にヒータHT(図1内4)を点灯

または消灯させる信号OUTが出力される。例えば、OUT出力がHレベルのときには、トランジスタTRがOFFとなり、ホトトライアックPTの発光側は消灯している。このとき、ホトトライアックPTの受光側もOFFであるので、トライアックTのゲート電流は流れない。よって、トライアックTはOFF状態となり、ヒータは消灯となる。反対に、OUTがLOWレベルのときは、上述の逆の動作をし、TRはON、PTの発光ダイオードは点灯し、ホトトライアックPT受光側はONする。トライアックTのゲートへは、ホトトライアックPT受光側が導通するから、抵抗R2またはR3によって限流されたゲート電流が供給される。従って、トライアックTは導通となって、ヒータは点灯する。Tに並列に接続されたR4とC1は、スナバ回路であり、外来ノイズなどの影響によって電源電圧の急激な変化があったとき、トライアックTが自立的にONするのを防止するためのものである。

【0040】この図7の回路による本実施の形態におけるヒータ制御の過程を、再度図5により説明する。まず図示したように制御温度を $Ta > Tb > Tc$ の関係を持たせた3つの閾値を設定する。図7内A/D端子に入力される温度検知信号が $Tc$ 以下の場合には、ヒータに対し全通電パターン(3/3)を与え、温度が $Tb \geq T > Tc$ の範囲になった時点で、ヒータに対し通電パターン(2/3)を与える。更に、温度が上昇し $Ta \geq T > Tb$ のレベルとなった場合は、ヒータ通電電力をもっと低下させ通電パターン(1/3)を印加する。温度が $T \geq Ta$ となる場合は、無通電パターン(0/3)を与える。温度が低下して来た場合は、前記の逆の過程をたどり、温度によって通電(1/3)→通電(2/3)→通電(3/3)とヒータの電力を増大させるようにする(図5内(b)の過程を示す。)

【0041】図8にスタンバイ中とプリント(コピー)中における、実際の温調(温度調整)状態を示してある。スタンバイ中の平均電力がヒータ全電力の1/3以下であるとすれば、通電(0/3)と通電(1/3)の間を往復する形で温度が平衡する。また、プリント中の平均電力がヒータ全電力の(1/3)と(2/3)の間にあるとすれば、通電(1/3)と通電(2/3)間を行き来する形で、温度が平衡することとなる。図示したように通電状態の切り換え頻度が高い場合には、フリッカ値に対しては不利に働く。従ってこの頻度を低下させる例として、ある通電状態に突入したとき、前述したように、その状態に留まる最低継続時間を定めことにより、この頻度を低下させることが可能である。

【0042】図8から分かるように、スタンバイ状態に入る最初の装置電源ON時には、通電(3/3)となっており、突入電流が発生しうる。しかし、一旦温度が最大閾値 $Ta$ に達した後は、通電(0/3)からは必ず通電(1/3)、(2/3)を経由して通電(3/3)に

達する。すなわち、本発明は装置電源ON時以外の温調時のヒータ制御に向けられているといえる。装置電源ON時の突入電流に対処するには、装置電源ON直後のみ上記のような従来の手法を採用してもよい。

【0043】図9および図10に跨るフローチャートにより、前記制御を実現するためのソフトウェア手順を説明する。ここでは、3半波長周期を基準とし、最低継続時間を所定値にセットした場合を例とする。

【0044】CPU(図7)に対する割り込み入力端子INTに対しては、前記ゼロクロスパルス発生回路からゼロクロスパルスが与えられているから、このパルスの発生(パルス立下り)毎に、CPU内処理に割り込み(INT)が掛かり図9から始まるフロー手順が実行される。

【0045】まず、判断ステップS1によって、ヒータローラ温度をサンプルすべきタイミングを指示する温度サンプルフラグ(以下、および図9、図10においてフラグをFで表す)を調べる。このフラグのセット、リセットは後述するステップで行われる。このフラグがセットされていれば、S1のY側へフローが移行して、温度Tがサンプルされる(S19)。ついで、判断ステップS2、S3、S4により温度Tの属する範囲が判定され、対応する細部フローへと移動する。

【0046】具体的には、判断ステップS2で $T > T_a$ であればそのY側へ移行して、通電状態フラグ群0/3F、1/3F、2/3F、3/3Fのうち、通電状態フラグ0/3Fのみセットされる。そして合流点(d)へ移行する。

【0047】判断ステップS3で $T_a \leq T < T_b$ であれば、そのY側へ移行し、既に通電状態フラグ1/3Fがセットされているか否かをチェックする(S6)。セットされていないければ、継続カウンタをスタートさせる(S23)。この継続カウンタは、前述した最低継続時間を計測するためのものである。ついで、通電状態フラグ1/3Fをセットし他の通電状態フラグ(1/3F、2/3F、3/3F)をすべてリセットする(S24)。判断ステップS6で既に通電状態フラグ1/3Fがセットされている場合にも念のために同ステップS24を実行する。

【0048】判断ステップS4で $T_b \leq T < T_c$ であれば、そのY側へ移行し、既に通電状態フラグ2/3Fがセットされているか否かをチェックする(S7)。セットされていないければ、継続カウンタをスタートさせる(S25)。ついで、通電状態フラグ2/3Fをセットし他の通電状態フラグ(0/3F、1/3F、3/3F)をすべてリセットする(S26)。判断ステップS7で既に通電状態フラグ2/3Fがセットされている場合にも念のために同ステップS26を実行する。

【0049】判断ステップS4で $T_b \leq T < T_c$ でなければ、すなわち $T_c \leq T$ であれば、そのY側へ移行し、

既に通電状態フラグ3/3Fがセットされているか否かをチェックする(S8)。セットされていないければ、継続カウンタをスタートさせる(S27)。ついで、通電状態フラグ3/3Fをセットし他の通電状態フラグ(0/3F、1/3F、2/3F)をすべてリセットする(S28)。判断ステップS8で既に通電状態フラグ3/3Fがセットされている場合にも念のために同ステップS28を実行する。

【0050】前述した判断ステップS1で温度サンプルFがセットされていない場合または前記S22、S24、S26、S28に続き、間引きカウンタをインクリメントする(S20)。間引きカウンタは、割り込み毎にインクリメントされ、その値が3になると(S9)、0にリセットされる(S21)。したがって、間引きカウンタの値は、 $0 \rightarrow 1 \rightarrow 2 \rightarrow 0 \rightarrow \dots$  の形で巡回する。この間引きカウンタは、後続の処理でその値を監視することにより波数間引きタイミングを管理するためのものである。すなわち、図10の判断ステップS10、S11、S12、S13へと移行し、その割り込みが3半波内のどの半波に対応し、かつ、その時点の各通電状態フラグの設定状態に応じて、当該半波をONするかOFFするかを判断し、制御信号の出力を指示する。

【0051】具体的には、判断ステップS10では、通電状態フラグ0/3Fのセットの有無を見て、Yesであれば間引きカウンタの値に関わらず出力信号OUTをONしヒータを消灯する(S31)。

【0052】判断ステップS11では、通電状態フラグ1/3Fのセットの有無を調べ、Yesであれば間引きカウンタが0のときのみ(S14、Yes)ヒータをONし(S33)、それ以外のときにはOFFする(S32)。よって、3半波内の1半波のみON、2半波間引きとなる。

【0053】判断ステップS12では、通電状態フラグ2/3Fのセットの有無を調べ、Yesであれば間引きカウンタが2のときのみ(S15、Yes)ヒータをOFFし(S35)、それ以外のときにはヒータはONする(S34)。すなわち、3半波のうち、1半波(間引きカウンタが2のとき)間引くこととなる。

【0054】判断ステップS13では、通電状態フラグ3/3Fのセットの有無を調べ、Yesであれば、間引きカウンタの値に関わらずヒータをONとする(S36)。すなわち、ヒータは全通電となる。判断ステップS13で判断結果がNoであれば、温度サンプルFをセットし(S37)、本割り込み処理を終了する(リターンする)。ステップS37は、初期時点等または何らかの理由でいずれの通電状態フラグもセットされていない場合に対処するためのものである。

【0055】S31~S36の各ヒータのON/OFF設定に続く判断ステップS16では、間引きカウンタ値を調べ、3半波長周期の区切り(最後の半波)かどうか

か、すなわち間引きカウンタ値が2か否かを調べる。このような区切りの位置でなければ、温度サンプルFをリセットし(S39)、リターンする。

【0056】判断ステップS16で間引きカウンタが2のとき、即ち3半波長周期の区切り(最後の半波)に来たときに、次の判断ステップS17で継続カウンタがカウント中か否かを調べる。継続カウンタがカウント中とは、先のステップS23、S25、S27のいずれかで継続カウンタがスタートされたことを意味する。カウント中であれば継続カウンタをインクリメントする(S38)。この継続カウンタは、前述したように、強制的に通電状態を一定時間(3半波長周期の倍数)以上持続するために設定されている。この継続カウンタが所定値に達していなければ(S18、No)、合流点(g)に移行する。ここで、温度サンプルFがリセットされる(S39)。よって、次の割り込みサイクルでは、温度サンプルはなされず間引きカウンタ値に基づいた波数間引き通電が引き続き持続されることとなる。このようにして、通電状態の最低継続時間を継続カウンタで管理している。

【0057】S18で継続カウンタが所定値に達している場合には、継続カウンタを停止させる(S40)。また、温度サンプルFをセットすることによって(S41)、次の割り込みルーチンの始めに温度サンプルを行って、通電状態を温度サンプルに応じて切り換えることを指示する。

【0058】ステップS41で温度サンプルFがセットされた後の次の割り込みルーチンの初め(図9)には、温度Tがサンプルされ(S19)、ステップS1にてY側へ移行してその温度Tを調べることになる。例えば、温度が $T_a \geq T > T_b$ 内にあれば、判断ステップS3のY側へ流れて、ステップS6で、以前セットしていた通電状態フラグが、これからセットする通電状態フラグ1/3Fと同じかどうか判断する。同じ場合には、継続カウンタをスタートさせず停止させたままにして同1/3Fのみをセットし(S24)、次の合流点(d)へと移行させる。以後、3半波長周期の間、2半波間引きがなされ、3半波長周期の区切りで(S16でY側)、継続カウンタは既に停止しているので、S17でN側へ処理移行し、再び温度サンプルFがセットされる(S41)。

【0059】同様に次の割り込みルーチン開始時に判断ステップS1でY側へ流れて、例えば温度が $T_b \geq T > T_c$ で判断ステップS4を通過したとすれば、直前の通電状態Fは1/3Fであったから、判断ステップS7で通電状態の切り換えがあると見なしN側へ処理移行し、継続カウンタをスタートさせ(S25)、かつ2/3Fをセットする(S26)。この2/3通電は、少なくとも、継続カウンタに指示された時間継続することになる。

【0060】判断ステップS2においては、Y側で直前のフラグの調査をせず、継続カウンタのスタート指示はなく、ここでセットされる通電F(0/3F)の最低継続時間を指定していない。すなわち本実施の形態では、0/3通電状態に対しては、3半波長周期を超える継続を故意に指示していない。定着ヒータの完全消灯は、用紙への定着性という観点から継続するのは望ましくないため、強制的な継続性を、あえて無い状態としている。

【0061】以上述べた、3半波長基準の本実施の形態のメリットとしては次のような事項が挙げられる。

【0062】(1)電源電圧の連続する3半波長分を周期として、半波の間引きの無い(3/3)通電と、3半波長を周期として1半波の間引き(2/3)通電と、2半波の間引き(1/3)通電と、通電無し(0/3)の4段階の通電パターンを、ヒータの加熱対象温度の4分割範囲にそれぞれ対応づける4値制御により、従来の2値制御に比べてよりきめ細かな高精度の温度制御を達成できる。

【0063】同時に、継続的な温度調整において、通電状態の変化(差分)は常に1/3(図8参照)すなわち1周期当たり半波分なので、ヒータ通電の急激な電流変化を効果的に低減することができる。

【0064】(2)また、制御ハードウェアが比較的単純である。例えば、前述したような位相制御方式の場合、電源電圧のゼロクロス点からタイマを設定してヒータをONすべき位相角を指定するパルスが発生させる必要がある。これらは、制御自体の複雑性とタイマ機構等のハードウェアを用意しなければならない。これに対して、「波数制御」であれば、ゼロクロス起点でヒータをONするのみであるため、位相を決定するタイマが不要となる。また、その分それらの設定、起動等、制御上の複雑性は減少する。

【0065】(3)さらに、「波数制御」の場合のヒータ電流は、ゼロクロス起点から印加されるため、電源ライン上における電源周波数の高次の周波数電流変化、いわゆる電源高調波の発生が殆どない。通常、このような電源高調波の発生を抑えるために、ヒータと直列に大容量のインダクタンス(チョークコイル)を挿入したりして、余計な電気部品の追加によるコスト上昇とその設置場所の確保による機械のコンパクト化に対する障害になっていたが、本実施の形態によりこのような問題が解消される。

【0066】以上、本発明の好適な実施の形態について説明したが、種々の変形、変更が可能である。

【0067】

【発明の効果】本発明によれば、2値制御とは異なる多値制御を行うことにより、温度調整中によりきめ細かな温度制御を行うとともに電流変動(フリッカ値)を低減することができる。

50 【図面の簡単な説明】



【図1】本発明が適用される対象の一例としての定着ローラの概略図である。

【図2】図1のヒータローラの温度調整のための従来のON/OFF温度制御時のヒータ通電電流波形を示す図である。

【図3】従来の位相制御（導通角制御）によるヒータへの通電の説明図である。

【図4】機器電流変動に起因する電源電圧の変動の発生の説明図である。

【図5】本発明の実施の形態における4つの温度範囲（a）と異なる間引き数の通電状態（b）と、異なる通電状態の波形（c）を示す図である。

【図6】本発明の他の実施の形態における、3半波長周期を2周期分セットにし6半波を新たな1周期とした通電パターンの説明図である。

\*

\* 【図7】本発明の実施の形態の波数制御を実現するための制御回路の回路図である。

【図8】本発明の実施の形態でのスタンバイ中とプリント（コピー）中における、実際の温調（温度調整）状態の一例を示す波形図である。

【図9】本発明の実施の形態における波数制御を実現するためのソフトウェア手順を示すフローチャートである。

【図10】図9に続くフローチャートである。

【符号の説明】

- 1 ヒータローラ
- 2 加圧ローラ
- 3 用紙
- 4 ヒータ
- 5 サーミスタ温度センサ

【図1】

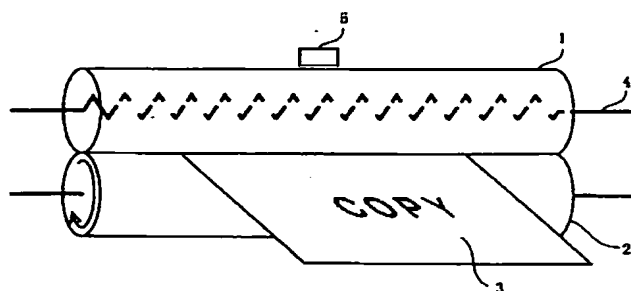


図1

【図2】

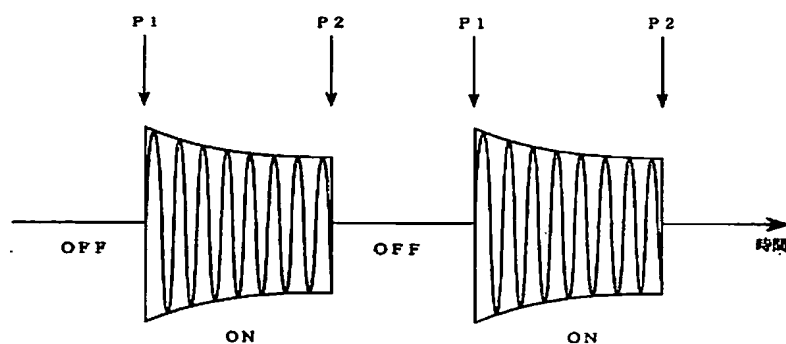


図2 電流波形

【図6】

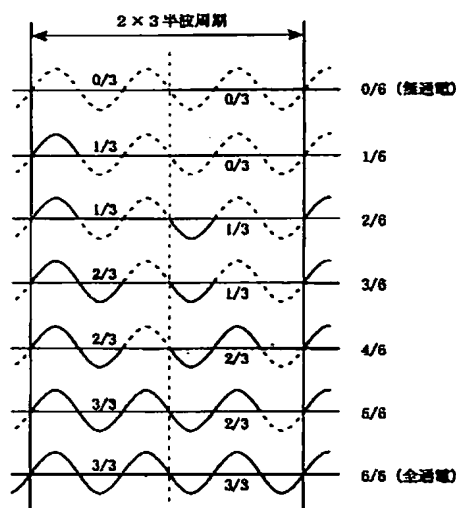


図6

【図3】

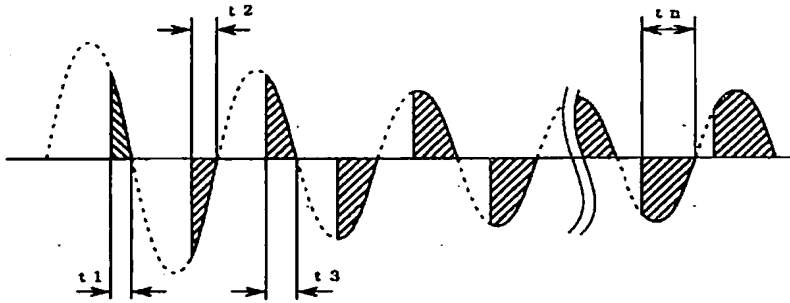


図3 ヒータ電流 (位相制御)

【図4】

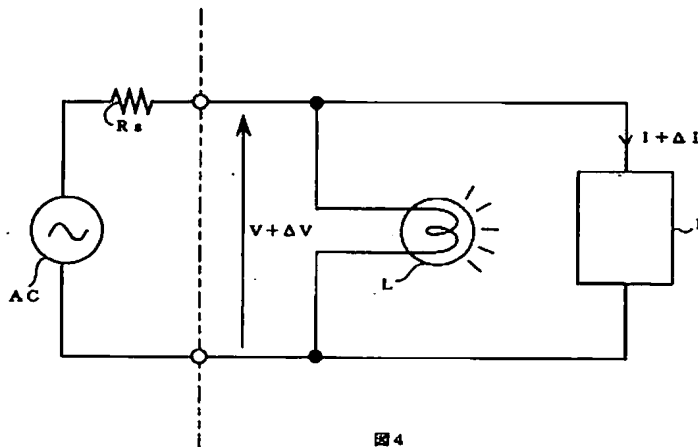


図4

【図7】

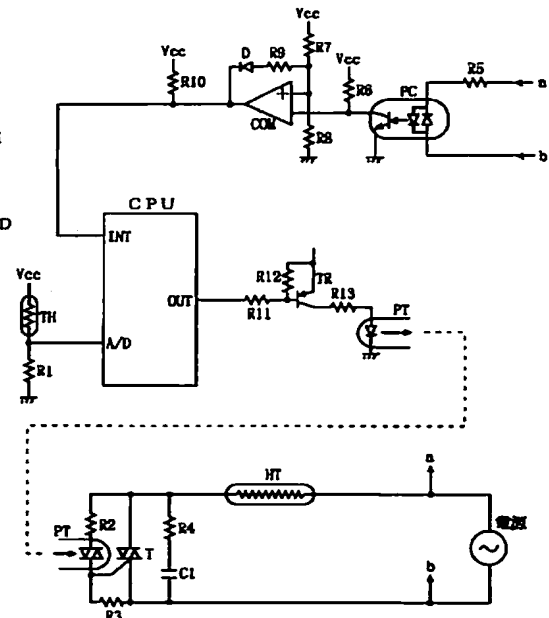


図7

【図8】

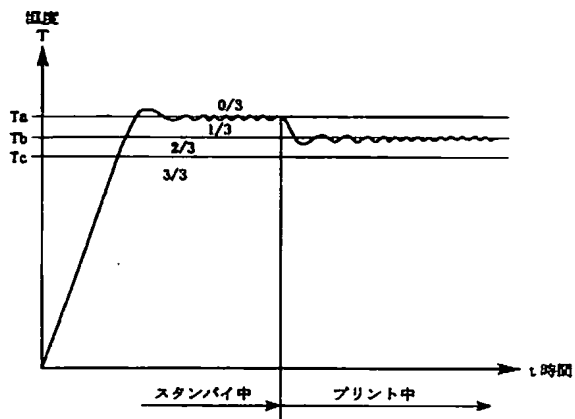


図8

【図 5】

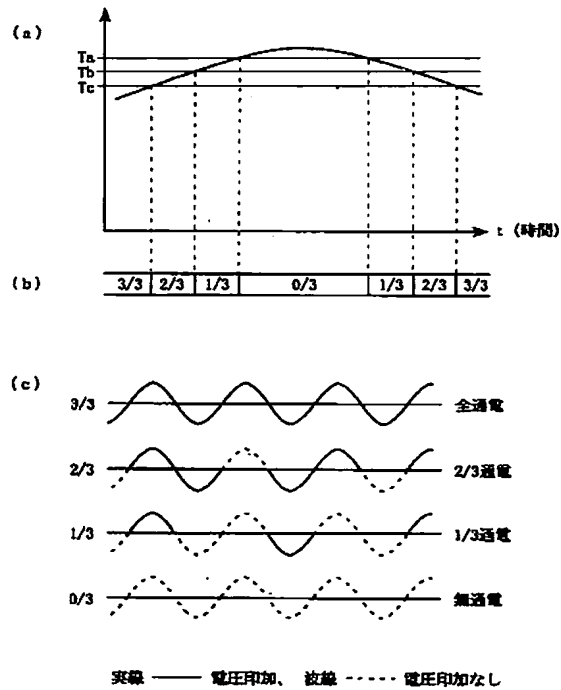


図 5

【図 9】

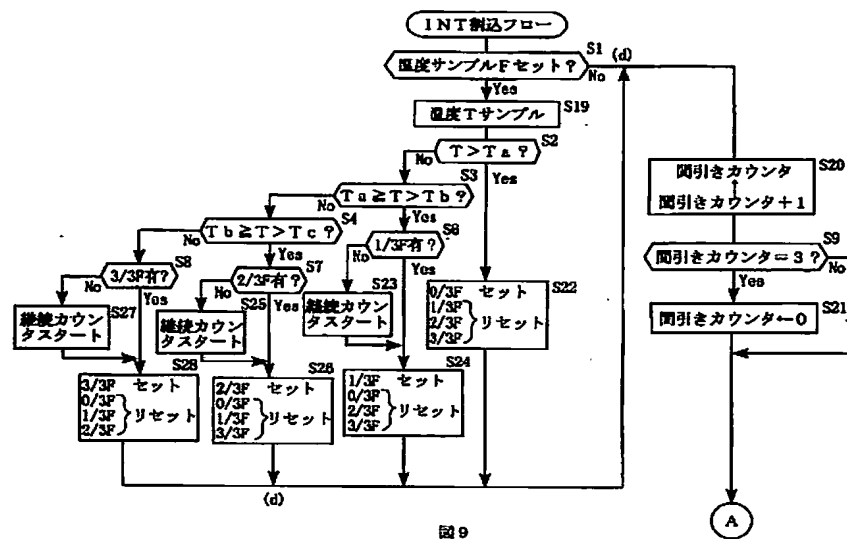


図 9

【図10】

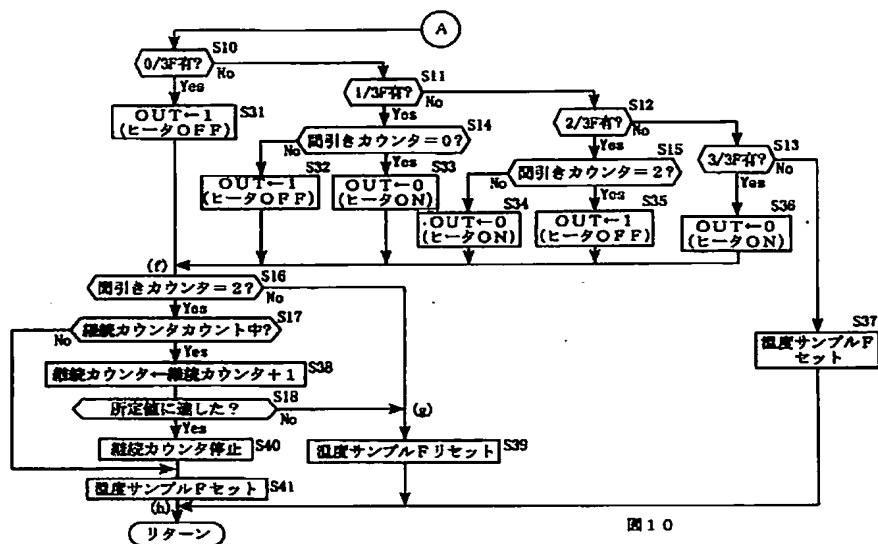


図10

フロントページの続き

(51) Int. Cl.<sup>7</sup>

G 0 5 F 1/455

識別記号

F I

G 0 5 F 1/455

テマコード (参考)

A

F ターム (参考) 2H033 AA41 BA24 CA47 CA48  
 3K058 AA24 AA27 BA18 CA05 CA12  
 CA23 CA46 CA61 CB05 CB09  
 CB10 CB23 CB32 CD01 CD02  
 CE12 CE17 DA02 GA06  
 5H323 AA36 BB01 BB09 CB04 DA02  
 DB04 FF03 GG04 MM15  
 5H420 BB12 CC04 DD03 EA05 EB03  
 EB05 EB13 EB26 FF04 FF14  
 FF26 LL07

PATENT ABSTRACTS OF JAPAN

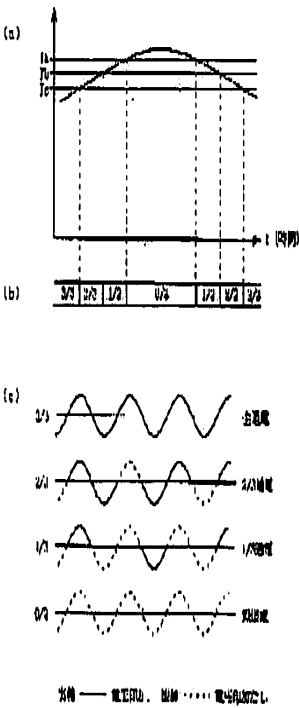
(11)Publication number : 2002-050450  
(43)Date of publication of application : 15.02.2002

(51)Int.Cl. H05B 3/00  
G03G 15/20  
G05D 23/24  
G05F 1/45  
G05F 1/455

(21)Application number : 2000-237162 (71)Applicant : CANON INC  
(22)Date of filing : 04.08.2000 (72)Inventor : NISHIDA YOSHIAKI

(54) HEATER CONTROL METHOD AND PICTURE FORMING DEVICE

(57)Abstract:  
PROBLEM TO BE SOLVED: To perform a careful temperature control in the midst of temperature control by multi-valued control which is different from binary-valued control, and to reduce a variation of current (a flicker value).  
SOLUTION: The temperature of an object to be heated by a heater is divided into four temperature ranges divided by three threshold values Ta, Tb and Tc. On the other hand, one period of an alternating current of power source is made to include three half-waves, and four wave forms such as the first wave form of



full-wave, the second wave form with deletion of one half-wave, the third wave form with deletion of two half-waves, and a no conduction are prepared, and they are allocated to the four temperature ranges from low temperature side in above sequence respectively. When the temperature of the heater is controlled, the temperature of the object to be heated is detected one after the other, and judged whether to which temperature range out of above four temperature ranges the detected temperature belongs, and the heater is controlled by the wave form corresponding to the temperature range to which, the temperature of the object to be heated belongs.

LEGAL STATUS  
[Date of request for examination]  
[Date of sending the examiner's decision of rejection]  
[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]  
[Date of final disposal for application]  
[Patent number]  
[Date of registration]  
[Number of appeal against examiner's decision of rejection]  
[Date of requesting appeal against examiner's decision of rejection]  
[Date of extinction of right]

Copyright (C); 1998,2003 Japan Patent Office

## \* NOTICES \*

JPO and NCIP are not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.\*\*\* shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

## CLAIMS

## [Claim(s)]

[Claim 1] The step which is the heater control approach at the time of driving a heater by AC power supply, and detects the temperature for [ of a heater ] heating serially, The step which judges to which temperature requirement of the four temperature requirements divided with three thresholds this detected temperature belongs, It is the energization pattern which made the period a part for the 3 half-wave lengths which supply voltage follows. The 1st energization pattern which does not have infanticide of a half wave, the 2nd energization pattern which thins out one half wave, The 3rd energization pattern which thins out two half waves, and the 4th energization pattern without energization The heater control approach characterized by having the step which controls said heater by the energization pattern which assigned said four temperature requirements from the side with respectively low temperature, and was assigned to said judged temperature requirement.

[Claim 2] Control of said heater by at least one of the said 2nd, 3rd, and 4th energization patterns is the heater control approach according to claim 1 characterized by the thing longer than at least 1 period which set beforehand, and to do for time amount continuation, without taking the temperature for [ said ] heating into consideration.

[Claim 3] The temperature threshold which is the heater control approach according to claim 1 or 2, and is made to shift to the 1st energization pattern from the 2nd energization pattern Ta, When the temperature threshold which makes the temperature threshold made to shift to the 2nd energization pattern from the 3rd energization pattern shift to the 3rd energization pattern from Tb and the 4th energization pattern is set to Tc, While making relation of these temperature thresholds into  $Ta > Tb > Tc$ , conversely The temperature threshold made to shift to the 2nd energization pattern from the 1st energization pattern Ta', When the temperature threshold made to shift

to the 3rd energization pattern from the 2nd energization pattern is made into Tb' and the temperature threshold made to shift to the 4th energization pattern from the 3rd energization pattern is made into Tc', The heater control approach characterized by considering as the relation of  $Ta > Ta' > Tb > Tb' > Tc > Tc'$  (however, the conditions which make all these three formulas an equal sign are removed).

[Claim 4] The step which is the heater control approach at the time of driving a heater by AC power supply, and detects the temperature for [ of a heater ] heating serially, The step which judges to which temperature requirement of the seven temperature requirements divided with six thresholds this detected temperature belongs, It is the energization pattern which made the period a part for the 3 half-wave lengths which supply voltage follows. The 1st energization pattern which does not have infanticide of a half wave, the 2nd energization pattern which thins out one half wave, The inside of the 3rd energization pattern which thins out two half waves, and the 4th energization pattern without energization, The 1st combination energization pattern which combined the 1st energization pattern and the 1st energization pattern, The 2nd combination energization pattern which combined the 2nd energization pattern and the 1st energization pattern, The 3rd combination energization pattern which combined the 2nd energization pattern and the 2nd energization pattern, The 4th combination energization pattern which combined the 3rd energization pattern and the 2nd energization pattern, The 5th combination energization pattern which combined the 3rd energization pattern and the 3rd energization pattern, The 6th combination energization pattern which combined the 4th energization pattern and the 3rd energization pattern, The 7th combination energization pattern which combined the 4th energization pattern and the 4th energization pattern The heater control approach characterized by having the step which controls said heater by the combination energization pattern which assigned said seven temperature requirements from the side with respectively low temperature, and was assigned to said judged temperature requirement.

[Claim 5] The step which is the heater control approach at the time of driving a heater by AC power supply, and detects the temperature for [ of a heater ] heating serially, The step which judges to which temperature requirement of the n temperature requirements (n is three or more integers) divided with the threshold of an individual (n-1) this detected temperature belongs, 1 or two or more energization patterns which made the period a part for m half-wave length which supply voltage follows (m is three or more odd number) are used as a unit energization pattern. The heater control approach characterized by having the step which energizes said heater by the energization pattern which assigned the n-th unit energization pattern to a

side with respectively low temperature to said n temperature requirements from the 1st used as the sequential size of the number of infanticide of a half wave, and was assigned to said judged temperature requirement.

[Claim 6] The fixing heater which is image formation equipment which has the anchorage device which fixes a toner image on a form, and is built in said anchorage device, A switching means to control the impression of an AC-power-supply electrical potential difference to this heater, A means to judge to which temperature requirement of the n temperature requirements (n is three or more integers) divided with the threshold of an individual (n-1) the temperature detected by temperature detection means to detect the temperature of said fixing heater, and said temperature detection means belongs, 1 or two or more energization patterns which made the period a part for m half-wave length which supply voltage follows (m is three or more odd number) are used as a unit energization pattern. The n-th unit energization pattern from the 1st used as the sequential size of the number of infanticide of a half wave Image formation equipment characterized by having the control means which controls said switching means by the energization pattern which assigned said n temperature requirements from the side with respectively low temperature, and was assigned to said judged temperature requirement.

[Translation done.]

## \* NOTICES \*

JPO and NCIPi are not responsible for any damages caused by the use of this translation.

1.This document has been translated by computer. So the translation may not reflect the original precisely.

2.\*\*\* shows the word which can not be translated.

3.In the drawings, any words are not translated.

## DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the heater control approach and image formation equipment which can reduce the rapid current variation at the time of energization of the heater for a temperature control especially mainly about heater control of the anchorage device built in image formation equipments, such as an electrostatic copying machine and a printer.

[0002]

[Description of the Prior Art] Conventionally, the halogen lamp with the comparatively large consumed electric current is used for this kind of heater, and big current variation, such as the rush current, occurs at the time of that ON.

[0003] Drawing 1 shows the schematic diagram of a fixing roller. A fixing roller has the heater roller 1 having a heater 4, and the application-of-pressure roller 2 pressurized to this heater roller 1. Thermal melting arrival of the toner image developed on the form 3 is carried out on a form 3 by passing a form 3 between both this roller 1 and 2.

[0004] Drawing 2 shows the heater energization current wave form at the time of the conventional ON/OFF control for the temperature control of the heater roller 1. In this wave, the OFF condition of a heater and ON condition change and P1 and the P2 section are the rapid current change parts corresponding to an event. This current variation produced the voltage variation of the supply power source itself, and has caused CHIRATSUKI, such as lighting connected to the same power source. That is, generally, as shown in drawing 4, when the supply power source AC is seen from the outside of a power receptacle, the comparatively small source impedance Rs exists. For this reason, when the consumed electric current of the connection device (here copying machine) D to a power source AC changes suddenly a lot, it originates in the voltage drop by source impedance Rs, and

fluctuation of supply voltage occurs.  $\Delta I$ , then rapid line-voltage-variation part  $\Delta V$  are expressed with a degree type in a rapid current change. [0005]  $\Delta V = R_s \times I_f$  If Luminaire L is connected to  $\Delta I$ , for example, this plug socket line, rapid line voltage variation will serve as CHIRATSUKI of lighting, and will appear. In recent years, the request which is going to reduce the line voltage variation by rapid current change of such a device has become strong.

[0006]

[Problem(s) to be Solved by the Invention] In order to prevent such CHIRATSUKI of a luminaire, it is necessary to make current change loose. That is, it is necessary to reduce the rapid current change by the halogen heater used for anchorage devices, such as a copying machine. (This is also called "reduction of a flicker value" on these descriptions.) It is required to specifically ease the rapid current change parts of P1 at the time of the halogen heater energization current ON shown in drawing 2 and the P2 section at the time of OFF.

[0007] The approach for solving this trouble is energization of HITAE by phase control (conduction angle control) as shown in drawing 3. As already stated, in order to prevent a rapid current change like [ at the time of rush current generating just behind Heater ON ], that what is necessary is just to enlarge applied voltage gradually effectually, in the form shown in the heater energization current wave form of drawing 3, first, the resistance welding time in each half-wave length of an AC-power-supply electrical potential difference is made small, and is enlarged gradually in the beginning ( $t_1$ ,  $t_2$ ,  $t_3$ , ...  $t_n$ ).

[0008] This approach is common knowledge and it is also possible to carry out moderate current change near a data ideal. However, the following faults also exist in the approach. 1. The timer style for deciding a phase angle etc. is considered that the hardware is complicated and the complexity on control of those setting out, starting, etc. becomes high similarly. 2. To the area (regional difference (50Hz and 60Hz)) where power line periods differ, another setting out is respectively required and there is complicatedness to carving management. 3. Since energization of HITAE is turned on not within a zero cross origin but within the half-wave length so that clearly even if it sees drawing 3, a higher-harmonic current increases. This current is generated by the high order wave (several times to dozens times) of a power line period. This does active jamming as other device HENOIZU connected through the feeder, and causes malfunction and failure. Therefore, in the case of phase control, in order to reduce this higher-harmonic-wave current, the response of inserting a mass choke coil is needed separately.

[0009] Except what is depended on phase control, the technique which supplies power to a heater so that a zero crossing point LGT may be carried

out at JP,9-80961,A with an alternating current discontinuous pattern which becomes power fewer than the energization power of rating according [ on-timing to predetermined time at least ] to alternating current continuation burning of the on-timing of a heater and off-timing is indicated. Moreover, the technique of the zero crossing point LGT in an anchorage device equipped with two heaters is indicated by JP,11-95611,A. By these, the rush current at the time of Heater ON can be reduced, and generating of a noise can be reduced.

[0010] Usually, in the anchorage device, in order to maintain the temperature of a heater roller to predetermined temperature, the continuous temperature control is performed. Although this predetermined temperature may change with modes of operation at the time of a copy and standby etc., ON/OFF of a heater is performed anyway by measuring the temperature of a heater roller with a predetermined value (threshold). That is, if temperature falls from a predetermined value, ON signal of a heater will be outputted, and if a predetermined value is exceeded, the OFF signal of a heater will be outputted. Although there is what the threshold at the time of a temperature rise and descent is changed for (that is, a hysteresis is given), the conventional heater control is binary control in principle anyway.

[0011] On the other hand, this invention aims at offering the new heater control approach and image formation equipment which can reduce current variation (flicker value) while it performs fine temperature control by the inside of a temperature control.

[0012]

[Means for Solving the Problem] In order to attain the above-mentioned object, the heater control approach by this invention The step which is the heater control approach at the time of driving a heater by AC power supply, and detects the temperature for [ of a heater ] heating serially, The step which judges to which temperature requirement of the four temperature requirements divided with three thresholds this detected temperature belongs, It is the energization pattern which made the period a part for the 3 half-wave lengths which supply voltage follows. The 1st energization pattern which does not have infanticide of a half wave, the 2nd energization pattern which thins out one half wave, It is characterized by having the step which controls said heater by the energization pattern which assigned the 3rd energization pattern which thins out two half waves, and the 4th energization pattern without energization to said four temperature requirements from the side with respectively low temperature, and was assigned to said judged temperature requirement.

[0013] Thus, while becoming possible to perform highly precise temperature control compared with control ON/OFF binary [ conventional ] by [ four ] dividing and assigning four different energization patterns (four values) to



each temperature requirement, reduction of the flicker value by reduction of current variation can also attain the temperature requirement for [ of a heater ] heating.

[0014] In this heater control approach, control of said heater by at least one of the said 2nd, 3rd, and 4th energization patterns is longer than at least 1 period preferably, without taking the temperature for [ said ] heating into consideration -- it set beforehand -- time amount continuation is carried out. By this, a flicker value can be further reduced compared with the case where such time amount continuation is not performed.

[0015] When the temperature threshold which makes the temperature threshold which makes the temperature threshold made to shift to the 1st energization pattern from the 2nd energization pattern shift to the 2nd energization pattern from Ta and the 3rd energization pattern in the above-mentioned heater control approach shift to the 3rd energization pattern from Tb and the 4th energization pattern is set to Tc, it is the relation of these temperature thresholds [0016] It is [0017] while considering as  $T_a > T_b > T_c$ . On the contrary, it is [0018] when the temperature threshold which the temperature threshold made to shift to the 2nd energization pattern from the 1st energization pattern is shifted to Ta', and makes the temperature threshold made to shift to the 3rd energization pattern from the 2nd energization pattern shift to the 4th energization pattern from Tb' and the 3rd energization pattern is made into Tc'. It can also consider as the relation of  $T_a = T_a' = T_b = T_b' = T_c = T_c'$  (however, the conditions which make all these three formulas an equal sign are removed). The so-called hysteresis is given to at least one of the thresholds of the boundary of this, i.e., four temperature requirements. This also has effectiveness in reduction of a flicker value.

[0019] The step which the another heater control approach by this invention is the heater control approach at the time of driving a heater by AC power supply, and detects the temperature for [ of a heater ] heating serially, The step which judges to which temperature requirement of the seven temperature requirements divided with six thresholds this detected temperature belongs, It is the energization pattern which made the period a part for the 3 half-wave lengths which supply voltage follows. The 1st energization pattern which does not have infanticide of a half wave, the 2nd energization pattern which thins out one half wave, The inside of the 3rd energization pattern which thins out two half waves, and the 4th energization pattern without energization, The 1st combination energization pattern which combined the 1st energization pattern and the 1st energization pattern, The 2nd combination energization pattern which combined the 2nd energization pattern and the 1st energization pattern, The 3rd combination energization pattern which combined the 2nd energization pattern and the 2nd

energization pattern, The 4th combination energization pattern which combined the 3rd energization pattern and the 2nd energization pattern, The 5th combination energization pattern which combined the 3rd energization pattern and the 3rd energization pattern, The 6th combination energization pattern which combined the 4th energization pattern and the 3rd energization pattern, The 7th combination energization pattern which combined the 4th energization pattern and the 4th energization pattern It is characterized by having the step which controls said heater by the combination energization pattern which assigned said seven temperature requirements from the side with respectively low temperature, and was assigned to said judged temperature requirement. This is also an example of another multiple-value control, and the same effectiveness as the above-mentioned heater control approach is acquired.

[0020] The step which the heater control approach by this invention is the heater control approach at the time of driving a heater by AC power supply according to another viewpoint, and detects the temperature for [ of a heater ] heating serially, The step which judges to which temperature requirement of the n temperature requirements (n is three or more integers) divided with the threshold of an individual (n-1) this detected temperature belongs, 1 or two or more energization patterns which made the period a part for m half-wave length which supply voltage follows (m is three or more odd number) are used as a unit energization pattern. It is characterized by having the step which energizes said heater by the energization pattern which assigned the n-th unit energization pattern to a side with respectively low temperature to said n temperature requirements from the 1st used as the sequential size of the number of infanticide of a half wave, and was assigned to said judged temperature requirement.

[0021] The equipment for enforcing the heater control approach of this invention The fixing heater which is image formation equipment which has the anchorage device which fixes a toner image on a form, and is built in said anchorage device, A switching means to control the impression of an AC-power-supply electrical potential difference to this heater, A means to judge to which temperature requirement of the n temperature requirements (n is three or more integers) divided with the threshold of an individual (n-1) the temperature detected by temperature detection means to detect the temperature of said fixing heater, and said temperature detection means belongs, 1 or two or more energization patterns which made the period a part for m half-wave length which supply voltage follows (m is three or more odd number) are used as a unit energization pattern. It is characterized by having the control means which controls said switching means by the energization pattern which assigned the n-th unit energization pattern to a side with respectively low temperature to said n temperature requirements from the

1st used as the sequential size of the number of infanticide of a half wave, and was assigned to said judged temperature requirement.

[0022]

[Embodiment of the Invention] Hereafter, the gestalt of suitable operation of this invention is explained to a detail.

[0023] First, the concept of this invention is explained. The approach of this invention can offer the heater control approach which can raise control precision more to the conventional heater ON/OFF (binary) control, and, thereby, can reduce a flicker value effectively. This heater control approach will be called "multiple-value proportional control."

[0024] The gestalt of one suitable operation is 4 value proportional control using the energization pattern of four values (0, 1/3, 2/3, 3/3) acquired by thinning out the half wave of the number which makes the 3 half-wave length one period, and is different from this one period. In this control, as shown in drawing 5 (a), three boundary values (threshold) which change four values are set to Ta, Tb, and Tc, and these relation is set as  $T_a > T_b > T_c$ . (For example, Tb is made into the target temperature at the time of a \*\* print or a copy.) To four temperature requirements divided with these boundary values, as shown in drawing 5 (b), the applied-voltage pattern (energization pattern) of one period which thinned out the half wave of the number of infanticide different, respectively is assigned. Supposing it carries out change as temperature shows to drawing 5 (a), four value energization patterns (energization condition) will change one by one like  $3/3 \rightarrow 2/3 \rightarrow 1/3 \rightarrow 0/3 \rightarrow 1/3 \rightarrow 2/3 \rightarrow 3/3$ . Drawing 5 (c) shows each energization pattern of these four values.

[0025] In addition, drawing 5 (a) does not show the temperature change of the actual heater roller 1 (drawing 1), and shows response relation with four energization patterns. But since the temperature of the heater roller 1 changes comparatively gently, you may think that change of electrical-potential-difference impression of heater 4 HE is produced gradually (difference every 3 [ 1/]). Therefore, it can be said that relaxation of a rapid current change is made by this approach.

[0026] It is also possible to apply the energization pattern which the aforementioned fundamental 4 value proportional control was developed, and was divided more into the multiple value. For example, the approach using the combination energization pattern which made the set a part for 2 of 3 half-wave length periods periods as a unit energization pattern is shown in drawing 6 as a gestalt of operation of the 2nd of this invention. In this case, six half waves become one period of a unit energization pattern.

[0027] Specifically, the condition of the seven following values is shown.

(1) The combination (0/6) energization pattern which combined (0/6) with no energizing (0/6), (2) The combination (1/6) energization pattern which

combined (0/3) with energization (1/3), (3) The combination (2/6) energization pattern which combined (1/3) with energization (1/3), (4) The combination (3/6) energization pattern which combined (1/3) with energization (2/3), (5) Combined (3/3) with the combination (4/6) energization pattern which combined (2/3) with energization (2/3), the combination (5/6) energization pattern which combined (2/3) with (6) energization (3/3), and (7) energization (3/3), namely, it is the combination (6/6) energization pattern of all energization.

[0028] Thus, the proportional control of a unit energization pattern, then seven values becomes possible about a part for 2 of 3 half-wave length periods periods (a part for the 6 half-wave length). Similarly, the phase of a set pattern, then ten values is acquired in a part for 3 of 3 half-wave length periods periods (a part for the 9 half-wave length). Furthermore, by increasing a period, a multiple value can be obtained more. Also in the form which used a part for a term (a part for the multiple for the 3 half-wave length) as the unit energization pattern such two or more rounds, since each current change will be set to one third if it compares with all mere energization ON/OFF, it is committed in the direction which reduces the rapid current change by heater energization.

[0029] Furthermore, an idea is advanced and CHIRATSUKI is explained for human being as the 1st modification of the gestalt of this operation of the approach of avoiding current change on a sensitive frequency (near 8Hz). What is necessary is just to move more the switch frequency to each condition of energization change  $3/3 \rightarrow 2/3 \rightarrow 1/3 \rightarrow 0 \rightarrow 1/3 \rightarrow 2/3 \rightarrow 3/3$  explained by drawing 5 in the low-pass direction from near 8Hz. That is, if the time amount (the number of 3 half-wave-length periods) which piles up in each condition of each energization pattern (1/3), (2/3), and (3/3) by carrying out the switch temperature Ta of each energization PATANHE and the difference of Tb, Tb, and Tc to beyond a predetermined value is managed so that it may become beyond a predetermined value compulsorily, current change frequency can be reduced and a change frequency can be moved more to low-pass. For example, in the experiment by this invention person who it was referred to [ person ] as  $T_a = 186\text{-degreeC}$ ,  $T_b = 185\text{-degreeC}$ , and  $T_c = 184\text{-degreeC}$ , and changed the minimum compulsive residence time (the minimum duration time) from 1 of 3 half-wave length periods period (three half waves) to eight periods (24 half waves) for every period about the halogen heater of 230V and 800W, the flicker value (Pst) measured in flicker meter carried out sequential lowering from 1.01 to 0.67. It is the flicker assessment value of the short time (for 10 minutes) as which Pst (Period Short Time) was determined here by the specification of EN 61000-3-3, for example, is EMC. It is indicated by 35th page - page [ 41st ] "the voltage variation and flicker measurement" of 1995.10.5 (No.90).

[0030] However, the responsibility of temperature control worsens and fluctuation of the temperature of a heater roller becomes large, so that the minimum duration time becomes long. Therefore, although it is desirable to carry out to more than 2 periods (6 half-wave length) as for the minimum duration time, if responsibility is also taken into consideration, 4 period order is desirable. That is, even if temperature control fluctuation becomes large somewhat compared with the case where the minimum duration time is one period, if it restricts to the range which does not spoil fixable, a flicker value can be reduced further.

[0031] In addition, the actual switch frequency of an energization condition is not decided by the above-mentioned minimum duration time, and serves as a frequency lower than the frequency converted by the minimum duration time for [ such as the heat history of a heater, ] effect.

[0032] As the 2nd modification of the gestalt of this operation, how to give thermal hysteresis is considered about Ta, Tb, and Tc. The temperature threshold when shifting to energization (0/3) from energization (1/3) For example, Ta, Tb and the temperature threshold of (3/3 → 2 / 3) are set to Tc for the temperature threshold of \*\* (2/3 → 1/3), and Tb' and the temperature threshold of (2/3 → 3 / 3) are determined [ the temperature threshold of (0/3 → 1 / 3) of hard flow ] for Ta' and the temperature threshold of (1/3 → 2 / 3) as Tc' to this. At this time, it is [0033]. It considers as the relation of Ta>Ta', Tb>Tb', and Tc>Tc' (however, the conditions which make all these three formulas an equal sign are removed).

[0034] Thus, a fluctuation frequency frequency can be moved in the low-pass direction by being easy to maintain the duration time of each energization pattern. Although this 2nd modification is employable independently of the 1st modification, it is also possible to use both modifications together. moreover, both modifications -- both -- again -- \*\* -- it is [ in / it is independent and / the gestalt of implementation of the above 2nd ] employable.

[0035] All were based on 3 half-wave length periods in the above example. Here, the advantage of applying wave number infanticide on the basis of 3 half-wave length periods is explained briefly. For example, since it will become the same dc component as a half-wave rectification wave if one period of an energization pattern is seen as the 2 half-wave lengths (one period of a sine wave form), and it will thin out by the 1 half-wave length from now on, the control top problem of a halogen heater is large. Moreover, infanticide with a period longer than 3 half-wave length periods becomes sensitive as CHIRATSUKI on the property of CHIRATSUKI, such as lighting, at the eyes of the infanticide actuation itself and a man. Therefore, it will be said that it is appropriate to think, the shortest periods, i.e., 3 half-wave length periods, other than 2 half-wave length periods. In fact, in infanticide of

this 3 half-wave-length period, most of the place which connected lighting actually and observed CHIRATSUKI, and a feeling of CHIRATSUKI was not sensed.

[0036] However, it is also possible to make the half wave of the odd number of 5 and 7 grades into a criteria period. In such a case, if compared with 3 half-wave length periods, though effectiveness will fall in respect of CHIRATSUKI, in addition, the effectiveness of reduction of current variation is accepted. The number of the temperature threshold in the case of m half-wave length period (m is three or more odd number) turns into the same number m.

[0037] Drawing 7 is the circuit diagram of the control circuit for realizing "wave number control" of the gestalt of this operation mentioned above.

[0038] TH in this drawing is a thermistor temperature sensor (5 in drawing 1) which detects the temperature of a heater roller (1 in drawing 1). This sensor TH is connected to resistance R1, and that partial pressure potential is inputted into analog input terminal A/D in a central processing unit CPU. Analog-to-digital conversion of the signal given to the A/D terminal is carried out, and it is processed within CPU. The zero cross pulse generated in the zero crossing point of supply voltage is inputted into the interruption input terminal INT of CPU. The generating circuit of this zero cross pulse is constituted by the photo coupler PC of the upper part of drawing 7 and Comparator COM, resistance R5-R10, and Diode D.

[0039] According to falling of a zero cross pulse, the interruption routine inside CPU (after-mentioned) is started, and the signal OUT which makes Heater HT (4 in drawing 1) turn on or switch off immediately after this zero cross signal falling is outputted. For example, when an OUT output is H level, Transistor TR was set to OFF and the luminescence side of phot triac PT has gone out. Since the light-receiving side of phot triac PT is also OFF at this time, the gate current of Triac T does not flow. Therefore, Triac T will be in an OFF condition and a heater will be switched off. Reversely, when OUT is LOW level, reversely, actuation of above-mentioned reverse is carried out, TR turns on the light emitting diode of ON and PT, and a phot triac PT light-receiving side turns on. Since a phot triac PT light-receiving side flows through GETOHE of Triac T, the gate current the \*\* style was carried out [ gate current ] by resistance R2 or R3 is supplied. Therefore, Triac T is flowed through it and turns on a heater. It is a snubber circuit, and when R4 and C1 which were connected to juxtaposition at T have the abrupt change of supply voltage under the effect of an outpatient department noise etc., it is for preventing that Triac T turns on independently.

[0040] Drawing 5 explains again the process of the heater control in the gestalt of this operation by the circuit of this drawing 7. Three thresholds which gave the relation of Ta>Tb>Tc for control temperature as illustrated

first are set up. When the temperature detection signal inputted into the A/D terminal in drawing 7 is below  $T_c$ , all energization patterns (3/3) are given to a heater and temperature becomes the range of  $T_b \geq T > T_c$ , an energization pattern (2/3) is given to a heater. Furthermore, when temperature rises and it is set to the level of  $T_a \geq T > T_b$ , heater energization power is reduced more and an energization pattern (1/3) is impressed. When temperature serves as  $T > T_a$ , a non-energized pattern (0/3) is given. When temperature has fallen, the process of the aforementioned reverse is followed and it is made to increase the power of energization (1/3)  $\rightarrow$  energization (2/3)  $\rightarrow$  energization (3/3) and a heater with temperature (the process of (b)) is shown in drawing 5 ).

[0041] The actual temperature control (temperature control) condition under standby to drawing 8 and print (copy) is shown. If the mean power under standby is 1/3 or less [ of all heater power ], temperature balances in the form which goes back and forth between energization (0/3) and energization (1/3). Moreover, if the mean power under print is between (2/3) with (one third) of all heater power, temperature will balance in the form where during energization (1/3) and energization (2/3) is gone back and forth. As illustrated, when the switch frequency of an energization condition is high, to a flicker value, it works disadvantageously. Therefore, as an example for which this frequency is reduced, when it rushes into a certain energization condition, as mentioned above, it is possible to define the minimum duration time which stops at that condition, and to reduce this frequency by things.

[0042] At the time of the first equipment power source ON included in a standby condition, it is energized (3/3) and the rush current may occur so that drawing 8 may show. However, once temperature reaches the maximum threshold  $T_a$ , from energization (0/3), energization (3/3) is surely reached via energization (1/3) and (2/3). That is, it can be said that this invention is turned to the heater control at the time of temperature control other than the time of equipment power-source ON. In order to cope with the rush current at the time of the equipment power source ON, immediately after the equipment power source ON may adopt the above conventional technique.

[0043] The flow chart over drawing 9 and drawing 10 explains the software procedure for realizing said control. Here, let the case where the minimum duration time is set to a predetermined value on the basis of 3 half-wave length periods be an example.

[0044] since the zero cross pulse is given from said zero cross pulse generating circuit to the interruption input terminal INT to CPU ( drawing 7 )  
 -- every [ of this pulse ] generating (pulse falling) -- the processing in CPU  
 -- interrupting (INT) -- the flow procedure which starts and begins from drawing 9 is performed.

[0045] First, the temperature sample flag (a flag is expressed with F in the

following and drawing 9 , and drawing 10 ) which directs the timing which should carry out the sample of the heater roller temperature by the decision step S1 is investigated. Set of this flag and reset are performed at the step mentioned later. If this flag is set, Y side HEFURO of S1 will shift and the sample of the temperature T will be carried out (S19). Subsequently, the range where temperature T belongs by the decision steps S2 and S3 and S4 is judged, and it moves to a corresponding details flow.

[0046] If it is  $T > T_a$  at the decision step S2, it will shift to the Y side and, specifically, only the energization status flags 0/3F will be set among the energization status flag group 0 / 1 / 2 / 3 [ 3F and ]/3F. [ 3F and 1 ] [ 3F and 2 ] And it shifts to a juncture (d).

[0047] If it is  $T_a \geq T > T_b$  at the decision step S3, it will shift to the Y side and it will be confirmed whether the energization status flags 1/3F are already set (S6). A continuation counter is started if not set (S23). This continuation counter is for measuring the minimum duration time mentioned above. Subsequently, the energization status flags 1/3F are set, and all other energization status flags (1/2 / 3 [ 3F and ]/3F) are reset (S24). [ 3F and 2 ] Also when the energization status flags 1/3F are already set at the decision step S6, this step S24 is performed for a sense.

[0048] If it is  $T_b \geq T > T_c$  in decision step S4, it will shift to the Y side and it will be confirmed whether the energization status flags 2/3F are already set (S7). A continuation counter is started if not set (S25). Subsequently, the energization status flags 2/3F are set, and all other energization status flags (0/1 / 3 [ 3F and ]/3F) are reset (S26). [ 3F and 1 ] Also when the energization status flags 2/3F are already set at the decision step S7, this step S26 is performed for a sense.

[0049] If it is not  $T_b \geq T > T_c$  in decision step S4 (i.e., if it is  $T_c \geq T$ ), it will shift to the Y side and it will be confirmed whether the energization status flags 3/3F are already set (S8). A continuation counter is started if not set (S27). Subsequently, the energization status flags 3/3F are set, and all other energization status flags (0/1 / 2 [ 3F and ]/3F) are reset (S28). [ 3F and 1 ] Also when the energization status flags 3/3F are already set at the decision step S8, this step S28 is performed for a sense.

[0050] Following said S22, S24, S26, and S28, when the temperature sample F is not set at the decision step S1 mentioned above, an infanticide counter is incremented (S20). The increment of the infanticide counter is carried out for every interruption, and if the value is set to 3, it will be reset by (S9) and 0 (S21). Therefore, the value of an infanticide counter is 0  $\rightarrow$  1  $\rightarrow$  2  $\rightarrow$  0  $\rightarrow$  ... It goes round in a form. This infanticide counter is for managing wave number infanticide timing by supervising that value by consecutive processing. That is, it shifts to the decision steps S10, S11, S12, and S13 of drawing 10 , and the interruption corresponds to which half wave in 3 half waves, and it judges

[ which turns on the half wave concerned according to the established state of each energization status flag at the event / or or ] whether OFF is carried out, and the output of a control signal is directed.

[0051] At the decision step S10, the existence of the set of the energization status flags 0/3F is seen, if it is Yes, it will thin out, and it is not concerned with the value of a counter, but an output signal OUT is turned on, and, specifically, a heater is switched off (S31).

[0052] At the decision step S11, the existence of the set of the energization status flags 1/3F is investigated, if it is Yes, it will thin out, only when a counter is 0, a heater is turned on (S33), and (S14, Yes) when other, it turns off (S32), only one half wave in 3 half waves is set to 4 with ON and 2 half-wave infanticide.

[0053] At the decision step S12, the existence of the set of the energization status flags 2/3F is investigated, if it is Yes, it will thin out, only when a counter is 2, a heater is turned off (S35), and (S15, Yes) when other, a heater is turned on (S34). That is, it will thin out 1 half wave of the three half waves (when an infanticide counter is 2).

[0054] At the decision step S13, the existence of the set of the energization status flags 3/3F is investigated, if it is Yes, it will not be concerned with the value of an infanticide counter, but a heater will be set to ON (S36). That is, a heater serves as all energization. If a decision result is No at the decision step S13, the temperature sample F will be set (S37) and this interruption processing will be ended (a return is carried out). Step S37 is for coping with it, when neither of the energization status flags is set by some reasons of an initial event etc.

[0055] At the decision step S16 following ON/OFF setting out of each heater of S31-S36, an infanticide counter value is investigated and that it is the break (the last half wave) of 3 half-wave length periods, i.e., an infanticide counter value, investigates whether it is 2. If it is not the location of such a break, the return of the temperature sample F will be reset and (S39) carried out.

[0056] It thins out at the decision step S16, and when a counter is 2 (i.e., when it comes to the break (the last half wave) of 3 half-wave length periods), a continuation counter investigates whether it is under [ count ] \*\*\*\*\* at the following decision step S17. During a count of a continuation counter, what the continuation counter started by either of previous steps S23, S25, and S27 is meant. A continuation counter will be incremented if it is under count (S38). This continuation counter is set up in order to maintain an energization condition beyond fixed time amount (multiple of 3 half-wave length periods) compulsorily, as mentioned above. If this continuation counter has not reached a predetermined value (S18, No), it shifts to a juncture (g). Here, the temperature sample F is reset (S39). Therefore, in the following

interruption cycle, a temperature sample is not made, but will be thinned out and the wave number infanticide energization based on a counter value will be maintained succeeding. Thus, the minimum duration time of an energization condition is managed with the continuation counter.

[0057] A continuation counter is stopped when the continuation counter has reached the predetermined value in S18 (S40). Moreover, it directs to perform a temperature sample at the beginning of (S41) and the following interruption routine, and to switch an energization condition according to a temperature sample by setting the temperature sample F.

[0058] The sample of the temperature T will be carried out (S19), it will shift to the Y side at step S1 at the beginning of the following interruption routine after the temperature sample F was set at step S41 ( drawing 9 ), and the temperature T will be investigated. For example, if temperature is in  $T_a > T_b$ , it will flow to the Y side of the decision step S3, and will judge whether the energization status flag before set at step S6 is the same as the energization status flags 1/3F to be set from now on. not starting a continuation counter and having made it stop freely, when the same -- carrying out -- said -- only 1/3F are set (S24), and it is made to shift to the next juncture (d) Henceforth, since 2 half-wave infanticide was made between 3 half-wave-length periods and Y side) and a continuation counter have already stopped by the break of 3 half-wave length periods (S16, processing shift is carried out by S17 at the N side, and temperature Sun Bull F is set again (S41).

[0059] If it flowed to the Y side at the decision step S1 similarly at the time of the next interruption routine initiation, for example, temperature passed decision step S4 by  $T_b > T_c$ , it considers that it has a switch of an energization condition at the decision step S7 since the last energization condition F was 1/3F, processing shift is carried out to the N side, and a continuation counter is started (S25), and 2/3F are set (S26). This 2/3 energization would be directed to the continuation counter at least, and will carry out time amount continuation.

[0060] In the decision step S2, the last flag is not investigated by the Y side, there are no start directions of a continuation counter, and the minimum duration time of the energization F (0/3F) set here is not specified. That is, with the gestalt of this operation, continuation exceeding 3 half-wave length periods is not intentionally directed to 0 / 3 energization condition. Since full putting out lights of a fixing heater of continuing from a viewpoint of fixable [ to a form ] is not desirable, compulsory continuity is made into the condition that there dares be nothing.

[0061] The following matters are mentioned as a merit of the gestalt of this operation of 3 half-wave length criteria expressed above.

[0062] (1) The energization which does not have infanticide of a half wave by

making into a period a part for the 3 half-wave lengths which supply voltage follows (3/3), Four steps of energization patterns [ having the energization which thins out one half wave by making the 3 half-wave lengths into a period (2/3), the energization which thins out two half waves (1/3), and no energization (0/3) ] by 4 value control matched with the quadrisection range of the temperature for heating of a heater, respectively Compared with the conventional binary control, the temperature control of finer high degree of accuracy can be attained.

[0063] Simultaneously, in a continuous temperature control, since change (difference) of an energization condition is always a part for a half wave per 1/3 (refer to drawing 8 ), 1 [ i.e. ], period, a rapid current change of heater energization can be reduced effectively.

[0064] (2) Moreover, control hardware is comparatively simple. For example, in the case of a phase control method which was mentioned above, it is necessary to generate the pulse which specifies the phase angle which should set up a timer from the zero crossing point of supply voltage, and should turn on a heater. These must prepare hardware, such as the complexity of the control [ itself ], and a timer style. On the other hand, if it is "wave number control", since it is only turning on a heater on a zero cross origin, the timer which determines a phase becomes unnecessary. Moreover, the complexity on control, such as those setting out and starting, decreases that much.

[0065] (3) Further, since the heater current in "wave number control" is impressed from a zero cross origin, it does not almost have a high order frequency current change of the power line period on a power-source line, and generating of the so-called power-source higher harmonic. Usually, such a problem is solved by the gestalt of this operation, although the mass inductance (choke coil) was inserted in the heater and the serial and it had become a failure over miniaturization of the machine by reservation of cost lifting by addition of an excessive electrical part, and its installation, in order to suppress generating of such a power-source higher harmonic wave.

[0066] As mentioned above, although the gestalt of suitable operation of this invention was explained, various deformation and modification are possible.

[0067]

[Effect of the Invention] According to this invention, by performing different multiple-value control from binary control, while the inside of a temperature control performs fine temperature control, current variation (flicker value) can be reduced.

---

[Translation done.]

## \* NOTICES \*

JPO and NCIP are not responsible for any damages caused by the use of this translation.

1.This document has been translated by computer. So the translation may not reflect the original precisely.

2.\*\*\* shows the word which can not be translated.

3.In the drawings, any words are not translated.

---

## TECHNICAL FIELD

[Field of the Invention] This invention relates to the heater control approach and image formation equipment which can reduce the rapid current variation at the time of energization of the heater for a temperature control especially mainly about heater control of the anchorage device built in image formation equipments, such as an electrostatic copying machine and a printer.

---

[Translation done.]

**\* NOTICES \***

JPO and NCIPi are not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.\*\*\* shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

---

**PRIOR ART**

[Description of the Prior Art] Conventionally, the halogen lamp with the comparatively large consumed electric current is used for this kind of heater, and big current variation, such as the rush current, occurs at the time of that ON.

[0003] Drawing 1 shows the schematic diagram of a fixing roller. A fixing roller has the heater roller 1 having a heater 4, and the application-of-pressure roller 2 pressurized to this heater roller 1. Thermal melting arrival of the toner image developed on the form 3 is carried out on a form 3 by passing a form 3 between both this roller 1 and 2.

[0004] Drawing 2 shows the heater energization current wave form at the time of the conventional ON/OFF control for the temperature control of the heater roller 1. In this wave, the OFF condition of a heater and ON condition change and P1 and the P2 section are the rapid current change parts corresponding to an event. This current variation produced the voltage variation of the supply power source itself, and has caused CHIRATSUKI, such as lighting connected to the same power source. That is, generally, as shown in drawing 4, when the supply power source AC is seen from the outside of a power receptacle, the comparatively small source impedance  $R_s$  exists. For this reason, when the consumed electric current of the connection device (here copying machine) D to a power source AC changes suddenly a lot, it originates in the voltage drop by source impedance  $R_s$ , and fluctuation of supply voltage occurs.  $\Delta I$ , then rapid line-voltage-variation part  $\Delta V$  are expressed with a degree type in a rapid current change.

[0005]  $\Delta V = R_s \times I_f$  Luminaire L is connected to  $\Delta I$ , for example, this plug socket line, rapid line voltage variation will serve as CHIRATSUKI of lighting, and will appear. In recent years, the request which is going to reduce the line voltage variation by rapid current change of such a device has become strong.

**\* NOTICES \***

JPO and NCIPi are not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.\*\*\* shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

---

**EFFECT OF THE INVENTION**

[Effect of the Invention] According to this invention, by performing different multiple-value control from binary control, while the inside of a temperature control performs fine temperature control, current variation (flicker value) can be reduced.

---

[Translation done.]

\* NOTICES \*

JPO and NCIPi are not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.\*\*\*\* shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

---

## TECHNICAL PROBLEM

---

[Problem(s) to be Solved by the Invention] In order to prevent such CHIRATSUKI of a luminaire, it is necessary to make current change loose. That is, it is necessary to reduce the rapid current change by the halogen heater used for anchorage devices, such as a copying machine. (This is also called "reduction of a flicker value" on these descriptions.) It is required to specifically ease the rapid current change parts of P1 at the time of the halogen heater energization current ON shown in drawing 2 and the P2 section at the time of OFF.

[0007] The approach for solving this trouble is energization of HITAE by phase control (conduction angle control) as shown in drawing 3. As already stated, in order to prevent a rapid current change like [ at the time of rush current generating just behind Heater ON ], that what is necessary is just to enlarge applied voltage gradually effectually, in the form shown in the heater energization current wave form of drawing 3, first, the resistance welding time in each half-wave length of an AC-power-supply electrical potential difference is made small, and is enlarged gradually in the beginning (t1, t2, t3, ... tn).

[0008] This approach is common knowledge and it is also possible to carry out moderate current change near a data ideal. However, the following faults also exist in the approach. 1. The timer style for deciding a phase angle etc. is considered that the hardware is complicated and the complexity on control of those setting out, starting, etc. becomes high similarly. 2. To the area (regional difference (50Hz and 60Hz)) where power line periods differ, another setting out is respectively required and there is complicatedness to carving management. 3. Since energization of HITAE is turned on not within a zero cross origin but within the half-wave length so that clearly even if it sees drawing 3, a higher-harmonic current increases. This current is generated by the high order wave (several times to dozens times) of a power line period. This does active jamming as other device HENOIZU connected

through the feeder, and causes malfunction and failure. Therefore, in the case of phase control, in order to reduce this higher-harmonic-wave current, the response of inserting a mass choke coil is needed separately.

[0009] Except what is depended on phase control, the technique which supplies power to a heater so that a zero crossing point LGT may be carried out at JP,9-80961,A with an alternating current discontinuous pattern which becomes power fewer than the energization power of rating according [ on-timing to predetermined time at least ] to alternating current continuation burning of the on-timing of a heater and off-timing is indicated. Moreover, the technique of the zero crossing point LGT in an anchorage device equipped with two heaters is indicated by JP,11-95611,A. By these, the rush current at the time of Heater ON can be reduced, and generating of a noise can be reduced.

[0010] Usually, in the anchorage device, in order to maintain the temperature of a heater roller to predetermined temperature, the continuous temperature control is performed. Although this predetermined temperature may change with modes of operation at the time of a copy and standby etc., ON/OFF of a heater is performed anyway by measuring the temperature of a heater roller with a predetermined value (threshold). That is, if temperature falls from a predetermined value, ON signal of a heater will be outputted, and if a predetermined value is exceeded, the OFF signal of a heater will be outputted. Although there is what the threshold at the time of a temperature rise and descent is changed for (that is, a hysteresis is given), the conventional heater control is binary control in principle anyway.

[0011] On the other hand, this invention aims at offering the new heater control approach and image formation equipment which can reduce current variation (flicker value) while it performs fine temperature control by the inside of a temperature control.

---

[Translation done.]



## \* NOTICES \*

JPO and NCIPi are not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.\*\*\* shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

## MEANS

[Means for Solving the Problem] In order to attain the above-mentioned object, the heater control approach by this invention The step which is the heater control approach at the time of driving a heater by AC power supply, and detects the temperature for [ of a heater ] heating serially, The step which judges to which temperature requirement of the four temperature requirements divided with three thresholds this detected temperature belongs, It is the energization pattern which made the period a part for the 3 half-wave lengths which supply voltage follows. The 1st energization pattern which does not have infanticide of a half wave, the 2nd energization pattern which thins out one half wave, It is characterized by having the step which controls said heater by the energization pattern which assigned the 3rd energization pattern which thins out two half waves, and the 4th energization pattern without energization to said four temperature requirements from the side with respectively low temperature, and was assigned to said judged temperature requirement.

[0013] Thus, while becoming possible to perform highly precise temperature control compared with control ON/OFF binary [ conventional ] by [ four ] dividing and assigning four different energization patterns (four values) to each temperature requirement, reduction of the flicker value by reduction of current variation can also attain the temperature requirement for [ of a heater ] heating.

[0014] in this heater control approach, control of said heater by at least one of the said 2nd, 3rd, and 4th energization patterns is longer than at least 1 period preferably, without taking the temperature for [ said ] heating into consideration -- it set beforehand -- time amount continuation is carried out. By this, a flicker value can be further reduced compared with the case where such time amount continuation is not performed.

[0015] When the temperature threshold which makes the temperature threshold which makes the temperature threshold made to shift to the 1st

energization pattern from the 2nd energization pattern shift to the 2nd energization pattern from Ta and the 3rd energization pattern in the above-mentioned heater control approach shift to the 3rd energization pattern from Tb and the 4th energization pattern is set to Tc, it is the relation of these temperature thresholds [0016] It is [0017] while considering as  $Ta > Tb > Tc$ . On the contrary, it is [0018] when the temperature threshold which the temperature threshold made to shift to the 2nd energization pattern from the 1st energization pattern is shifted to Ta', and makes the temperature threshold made to shift to the 3rd energization pattern from the 2nd energization pattern shift to the 4th energization pattern from Tb' and the 3rd energization pattern is made into Tc'. It can also consider as the relation of  $Ta = Ta' Tb = Tb' Tc = Tc'$  (however, the conditions which make all these three formulas an equal sign are removed). The so-called hysteresis is given to at least one of the thresholds of the boundary of this, i.e., four temperature requirements. This also has effectiveness in reduction of a flicker value.

[0019] The step which the another heater control approach by this invention is the heater control approach at the time of driving a heater by AC power supply, and detects the temperature for [ of a heater ] heating serially, The step which judges to which temperature requirement of the seven temperature requirements divided with six thresholds this detected temperature belongs, It is the energization pattern which made the period a part for the 3 half-wave lengths which supply voltage follows. The 1st energization pattern which does not have infanticide of a half wave, the 2nd energization pattern which thins out one half wave, The inside of the 3rd energization pattern which thins out two half waves, and the 4th energization pattern without energization, The 1st combination energization pattern which combined the 1st energization pattern and the 1st energization pattern, The 2nd combination energization pattern which combined the 2nd energization pattern and the 1st energization pattern, The 3rd combination energization pattern which combined the 2nd energization pattern and the 2nd energization pattern, The 4th combination energization pattern which combined the 3rd energization pattern and the 2nd energization pattern, The 5th combination energization pattern which combined the 3rd energization pattern and the 3rd energization pattern, The 6th combination energization pattern which combined the 4th energization pattern and the 3rd energization pattern, The 7th combination energization pattern which combined the 4th energization pattern and the 4th energization pattern It is characterized by having the step which controls said heater by the combination energization pattern which assigned said seven temperature requirements from the side with respectively low temperature, and was assigned to said judged temperature requirement. This is also an example of

another multiple-value control, and the same effectiveness as the above-mentioned heater control approach is acquired.

[0020] The step which the heater control approach by this invention is the heater control approach at the time of driving a heater by AC power supply according to another viewpoint, and detects the temperature for [ of a heater ] heating serially. The step which judges to which temperature requirement of the  $n$  temperature requirements ( $n$  is three or more integers) divided with the threshold of an individual ( $n-1$ ) this detected temperature belongs, 1 or two or more energization patterns which made the period a part for  $m$  half-wave length which supply voltage follows ( $m$  is three or more odd number) are used as a unit energization pattern. It is characterized by having the step which energizes said heater by the energization pattern which assigned the  $n$ -th unit energization pattern to a side with respectively low temperature to said  $n$  temperature requirements from the 1st used as the sequential size of the number of infanticide of a half wave, and was assigned to said judged temperature requirement.

[0021] The equipment for enforcing the heater control approach of this invention The fixing heater which is image formation equipment which has the anchorage device which fixes a toner image on a form, and is built in said anchorage device, A switching means to control the impression of an AC-power-supply electrical potential difference to this heater, A means to judge to which temperature requirement of the  $n$  temperature requirements ( $n$  is three or more integers) divided with the threshold of an individual ( $n-1$ ) the temperature detected by temperature detection means to detect the temperature of said fixing heater, and said temperature detection means belongs, 1 or two or more energization patterns which made the period a part for  $m$  half-wave length which supply voltage follows ( $m$  is three or more odd number) are used as a unit energization pattern. It is characterized by having the control means which controls said switching means by the energization pattern which assigned the  $n$ -th unit energization pattern to a side with respectively low temperature to said  $n$  temperature requirements from the 1st used as the sequential size of the number of infanticide of a half wave, and was assigned to said judged temperature requirement.

[0022]

[Embodiment of the Invention] Hereafter, the gestalt of suitable operation of this invention is explained to a detail.

[0023] First, the concept of this invention is explained. The approach of this invention can offer the heater control approach which can raise control precision more to the conventional heater ON/OFF (binary) control, and, thereby, can reduce a flicker value effectively. This heater control approach will be called "multiple-value proportional control."

[0024] The gestalt of one suitable operation is 4 value proportional control

using the energization pattern of four values (0, 1/3, 2/3, 3/3) acquired by thinning out the half wave of the number which makes the 3 half-wave length one period, and is different from this one period. In this control, as shown in drawing 5 (a), three boundary values (threshold) which change four values are set to  $T_a$ ,  $T_b$ , and  $T_c$ , and these relation is set as  $T_a > T_b > T_c$ . (For example,  $T_b$  is made into the target temperature at the time of a \*\* print or a copy.) To four temperature requirements divided with these boundary values, as shown in drawing 5 (b), the applied-voltage pattern (energization pattern) of one period which thinned out the half wave of the number of infanticide different, respectively is assigned. Supposing it carries out change as temperature shows to drawing 5 (a), four value energization patterns (energization condition) will change one by one like  $3/3 \rightarrow 2/3 \rightarrow 1/3 \rightarrow 0/3 \rightarrow 1/3 \rightarrow 2/3 \rightarrow 3/3$ . Drawing 5 (c) shows each energization pattern of these four values.

[0025] In addition, drawing 5 (a) does not show the temperature change of the actual heater roller 1 (drawing 1), and shows response relation with four energization patterns. But since the temperature of the heater roller 1 changes comparatively gently, you may think that change of electrical-potential-difference impression of heater 4 HE is produced gradually (difference every 3 [ 1/3]). Therefore, it can be said that relaxation of a rapid current change is made by this approach.

[0026] It is also possible to apply the energization pattern which the aforementioned fundamental 4 value proportional control was developed, and was divided more into the multiple value. For example, the approach using the combination energization pattern which made the set a part for 2 of 3 half-wave length periods periods as a unit energization pattern is shown in drawing 6 as a gestalt of operation of the 2nd of this invention. In this case, six half waves become one period of a unit energization pattern.

[0027] Specifically, the condition of the seven following values is shown. (1) The combination (0/6) energization pattern which combined (0/6) with no energizing (0/6), (2) The combination (1/6) energization pattern which combined (0/3) with energization (1/3), (3) The combination (2/6) energization pattern which combined (1/3) with energization (1/3), (4) The combination (3/6) energization pattern which combined (1/3) with energization (2/3), (5) Combined (3/3) with the combination (4/6) energization pattern which combined (2/3) with energization (2/3), the combination (5/6) energization pattern which combined (2/3) with (6) energization (3/3), and (7) energization (3/3), namely, it is the combination (6/6) energization pattern of all energization.

[0028] Thus, the proportional control of a unit energization pattern, then seven values becomes possible about a part for 2 of 3 half-wave length periods periods (a part for the 6 half-wave length). Similarly, the phase of a

set pattern, then ten values is acquired in a part for 3 of 3 half-wave length periods (a part for the 9 half-wave length). Furthermore, by increasing a period, a multiple value can be obtained more. Also in the form which used a part for a term (a part for the multiple for the 3 half-wave length) as the unit energization pattern such two or more rounds, since each current change will be set to one third if it compares with all mere energization ON/OFF, it is committed in the direction which reduces the rapid current change by heater energization.

[0029] Furthermore, an idea is advanced and CHIRATSUKI is explained for human being as the 1st modification of the gestalt of this operation of the approach of avoiding current change on a sensitive frequency (near 8Hz). What is necessary is just to move more the switch frequency to each condition of energization change  $3/3 \rightarrow 2/3 \rightarrow 1/3 \rightarrow 0 \rightarrow 1/3 \rightarrow 2/3 \rightarrow 3/3$  explained by drawing 5 in the low-pass direction from near 8Hz. That is, if the time amount (the number of 3 half-wave-length periods) which piles up in each condition of each energization pattern (1/3), (2/3), and (3/3) by carrying out the switch temperature Ta of each energization PATANHE and the difference of Tb, Tb, and Tc to beyond a predetermined value is managed so that it may become beyond a predetermined value compulsorily, current change frequency can be reduced and a change frequency can be moved more to low-pass. For example, in the experiment by this invention person who it was referred to [ person ] as Ta=186-degreeC, Tb=185-degreeC, and Tc=184-degreeC, and changed the minimum compulsive residence time (the minimum duration time) from 1 of 3 half-wave length periods period (three half waves) to eight periods (24 half waves) for every period about the halogen heater of 230V and 800W, the flicker value (Pst) measured in flicker meter carried out sequential lowering from 1.01 to 0.67. It is the flicker assessment value of the short time (for 10 minutes) as which Pst (Period Short Time) was determined here by the specification of EN 61000-3-3, for example, is EMC. It is indicated by 35th page - page [ 41st ] "the voltage variation and flicker measurement" of 1995.10.5 (No.90).

[0030] However, the responsibility of temperature control worsens and fluctuation of the temperature of a heater roller becomes large, so that the minimum duration time becomes long. Therefore, although it is desirable to carry out to more than 2 periods (6 half-wave length) as for the minimum duration time, if responsibility is also taken into consideration, 4 period order is desirable. That is, even if temperature control fluctuation becomes large somewhat compared with the case where the minimum duration time is one period, if it restricts to the range which does not spoil fixable, a flicker value can be reduced further.

[0031] In addition, the actual switch frequency of an energization condition is not decided by the above-mentioned minimum duration time, and serves as a

frequency lower than the frequency converted by the minimum duration time for [ such as the heat history of a heater, ] effect.

[0032] As the 2nd modification of the gestalt of this operation, how to give thermal hysteresis is considered about Ta, Tb, and Tc. The temperature threshold when shifting to energization (0/3) from energization (1/3) For example, Ta, Tb and the temperature threshold of (3/3  $\rightarrow$  2/3) are set to Tc for the temperature threshold of  $2/3 \rightarrow 1/3$ , and Tb' and the temperature threshold of (2/3  $\rightarrow$  3/3) are determined [ the temperature threshold of (0/3  $\rightarrow$  1/3) of hard flow ] for Ta' and the temperature threshold of (1/3  $\rightarrow$  2/3) as Tc' to this. At this time, it is [0033]. It considers as the relation of Ta>Ta', Tb>Tb', and Tc>Tc' (however, the conditions which make all these three formulas an equal sign are removed).

[0034] Thus, a fluctuation frequency frequency can be moved in the low-pass direction by being easy to maintain the duration time of each energization pattern. Although this 2nd modification is employable independently of the 1st modification, it is also possible to use both modifications together. moreover, both modifications — both — again — \*\* — it is [ in / it is independent and / the gestalt of implementation of the above 2nd ] employable.

[0035] All were based on 3 half-wave length periods in the above example. Here, the advantage of applying wave number infanticide on the basis of 3 half-wave length periods is explained briefly. For example, since it will become the same dc component as a half-wave rectification wave if one period of an energization pattern is seen as the 2 half-wave lengths (one period of a sine wave form), and it will thin out by the 1 half-wave length from now on, the control top problem of a halogen heater is large. Moreover, infanticide with a period longer than 3 half-wave length periods becomes sensitive as CHIRATSUKI on the property of CHIRATSUKI, such as lighting, at the eyes of the infanticide actuation itself and a man. Therefore, it will be said that it is appropriate to think, the shortest periods, i.e. 3 half-wave length periods, other than 2 half-wave length periods. In fact, in infanticide of this 3 half-wave-length period, most of the place which connected lighting actually and observed CHIRATSUKI, and a feeling of CHIRATSUKI was not sensed.

[0036] However, it is also possible to make the half wave of the odd number of 5 and 7 grades into a criteria period. In such a case, if compared with 3 half-wave length periods, though effectiveness will fall in respect of CHIRATSUKI, in addition, the effectiveness of reduction of current variation is accepted. The number of the temperature threshold in the case of m half-wave length period (m is three or more odd number) turns into the same number m.

[0037] Drawing 7 is the circuit diagram of the control circuit for realizing

"wave number control" of the gestalt of this operation mentioned above.

[0038] TH in this drawing is a thermistor temperature sensor (5 in drawing 1) which detects the temperature of a heater roller (1 in drawing 1). This sensor TH is connected to resistance R1, and that partial pressure potential is inputted into analog input terminal A/D in a central processing unit CPU. Analog-to-digital conversion of the signal given to the A/D terminal is carried out, and it is processed within CPU. The zero cross pulse generated in the zero crossing point of supply voltage is inputted into the interruption input terminal INT of CPU. The generating circuit of this zero cross pulse is constituted by the photo coupler PC of the upper part of drawing 7 and Comparator COM, resistance R5-R10, and Diode D.

[0039] According to falling of a zero cross pulse, the interruption routine inside CPU (after-mentioned) is started, and the signal OUT which makes Heater HT (4 in drawing 1) turn on or switch off immediately after this zero cross signal falling is outputted. For example, when an OUT output is H level, Transistor TR was set to OFF and the luminescence side of phot triac PT has gone out. Since the light-receiving side of phot triac PT is also OFF at this time, the gate current of Triac T does not flow. Therefore, Triac T will be in an OFF condition and a heater will be switched off. Reversely, when OUT is LOW level, reversely, actuation of above-mentioned reverse is carried out, TR turns on the light emitting diode of ON and PT, and a phot triac PT light-receiving side turns on. Since a phot triac PT light-receiving side flows through GETOHE of Triac T, the gate current the \*\* style was carried out [ gate current ] by resistance R2 or R3 is supplied. Therefore, Triac T is flowed through it and turns on a heater. It is a snubber circuit, and when R4 and C1 which were connected to juxtaposition at T have the abrupt change of supply voltage under the effect of an outpatient department noise etc., it is for preventing that Triac T turns on independently.

[0040] Drawing 5 explains again the process of the heater control in the gestalt of this operation by the circuit of this drawing 7. Three thresholds which gave the relation of  $T_a > T_b > T_c$  for control temperature as illustrated first are set up. When the temperature detection signal inputted into the A/D terminal in drawing 7 is below  $T_c$ , all energization patterns (3/3) are given to a heater and temperature becomes the range of  $T_b > T > T_c$ , an energization pattern (2/3) is given to a heater. Furthermore, when temperature rises and it is set to the level of  $T_a > T > T_b$ , heater energization power is reduced more and an energization pattern (1/3) is impressed. When temperature serves as  $T > T_a$ , a non-energized pattern (0/3) is given. When temperature has fallen, the process of the aforementioned reverse is followed and it is made to increase the power of energization (1/3) → energization (2/3) → energization (3/3) and a heater with temperature (the process of (b) is shown in drawing 5).

[0041] The actual temperature control (temperature control) condition under standby to drawing 8 and print (copy) is shown. If the mean power under standby is 1/3 or less [ of all heater power ], temperature balances in the form which goes back and forth between energization (0/3) and energization (1/3). Moreover, if the mean power under print is between (2/3) with (one third) of all heater power, temperature will balance in the form where during energization (1/3) and energization (2/3) is gone back and forth. As illustrated, when the switch frequency of an energization condition is high, to a flicker value, it works disadvantageously. Therefore, as an example for which this frequency is reduced, when it rushes into a certain energization condition, as mentioned above, it is possible to define the minimum duration time which stops at that condition, and to reduce this frequency by things.

[0042] At the time of the first equipment power source ON included in a standby condition, it is energized (3/3) and the rush current may occur so that drawing 8 may show. However, once temperature reaches the maximum threshold  $T_a$ , from energization (0/3), energization (3/3) is surely reached via energization (1/3) and (2/3). That is, it can be said that this invention is turned to the heater control at the time of temperature control other than the time of equipment power-source ON. In order to cope with the rush current at the time of the equipment power source ON, immediately after the equipment power source ON may adopt the above conventional technique.

[0043] The flow chart over drawing 9 and drawing 10 explains the software procedure for realizing said control. Here, let the case where the minimum duration time is set to a predetermined value on the basis of 3 half-wave length periods be an example.

[0044] since the zero cross pulse is given from said zero cross pulse generating circuit to the interruption input terminal INT to CPU (drawing 7) -- every [ of this pulse ] generating (pulse falling) -- the processing in CPU -- interrupting (INT) -- the flow procedure which starts and begins from drawing 9 is performed.

[0045] First, the temperature sample flag (a flag is expressed with F in the following and drawing 9, and drawing 10) which directs the timing which should carry out the sample of the heater roller temperature by the decision step S1 is investigated. Set of this flag and reset are performed at the step mentioned later. If this flag is set, Y side HEFURO of S1 will shift and the sample of the temperature T will be carried out (S19). Subsequently, the range where temperature T belongs by the decision steps S2 and S3 and S4 is judged, and it moves to a corresponding details flow.

[0046] If it is  $T > T_a$  at the decision step S2, it will shift to the Y side and, specifically, only the energization status flags 0/3F will be set among the energization status flag group 0 / 1 / 2 / 3 [ 3F and ]/3F. [ 3F and 1 ] [ 3F and 2 ] And it shifts to a juncture (d).

[0047] If it is  $T_a > T_b$  at the decision step S3, it will shift to the Y side and it will be confirmed whether the energization status flags 1/3F are already set (S6). A continuation counter is started if not set (S23). This continuation counter is for measuring the minimum duration time mentioned above.

Subsequently, the energization status flags 1/3F are set, and all other energization status flags (1/2 / 3 [ 3F and ]/3F) are reset (S24). [ 3F and 2 ] Also when the energization status flags 1/3F are already set at the decision step S6, this step S24 is performed for a sense.

[0048] If it is  $T_b > T_c$  in decision step S4, it will shift to the Y side and it will be confirmed whether the energization status flags 2/3F are already set (S7). A continuation counter is started if not set (S25). Subsequently, the energization status flags 2/3F are set, and all other energization status flags (0/1 / 3 [ 3F and ]/3F) are reset (S26). [ 3F and 1 ] Also when the energization status flags 2/3F are already set at the decision step S7, this step S26 is performed for a sense.

[0049] If it is not  $T_b > T_c$  in decision step S4 (i.e., if it is  $T_c > T$ ), it will shift to the Y side and it will be confirmed whether the energization status flags 3/3F are already set (S8). A continuation counter is started if not set (S27). Subsequently, the energization status flags 3/3F are set, and all other energization status flags (0/1 / 2 [ 3F and ]/3F) are reset (S28). [ 3F and 1 ] Also when the energization status flags 3/3F are already set at the decision step S8, this step S28 is performed for a sense.

[0050] Following said S22, S24, S26, and S28, when the temperature sample F is not set at the decision step S1 mentioned above, an infanticide counter is incremented (S20). The increment of the infanticide counter is carried out for every interruption, and if the value is set to 3, it will be reset by (S9) and 0 (S21). Therefore, the value of an infanticide counter is 0→1→2→0→... It goes round in a form. This infanticide counter is for managing wave number infanticide timing by supervising that value by consecutive processing. That is, it shifts to the decision steps S10, S11, S12, and S13 of drawing 10, and the interruption corresponds to which half wave in 3 half waves, and it judges [ which turns on the half wave concerned according to the established state of each energization status flag at the event / or or ] whether OFF is carried out, and the output of a control signal is directed.

[0051] At the decision step S10, the existence of the set of the energization status flags 0/3F is seen, if it is Yes, it will thin out, and it is not concerned with the value of a counter, but an output signal OUT is turned on, and, specifically, a heater is switched off (S31).

[0052] At the decision step S11, the existence of the set of the energization status flags 1/3F is investigated, if it is Yes, it will thin out, only when a counter is 0, a heater is turned on (S33), and (S14, Yes) when other, it turns off (S32). only one half wave in 3 half waves is set to 4 with ON and 2

half-wave infanticide.

[0053] At the decision step S12, the existence of the set of the energization status flags 2/3F is investigated, if it is Yes, it will thin out, only when a counter is 2, a heater is turned off (S35), and (S15, Yes) when other, a heater is turned on (S34). That is, it will thin out 1 half wave of the three half waves (when an infanticide counter is 2).

[0054] At the decision step S13, the existence of the set of the energization status flags 3/3F is investigated, if it is Yes, it will not be concerned with the value of an infanticide counter, but a heater will be set to ON (S36). That is, a heater serves as all energization. If a decision result is No at the decision step S13, the temperature sample F will be set (S37) and this interruption processing will be ended (a return is carried out). Step S37 is for coping with it, when neither of the energization status flags is set by some reasons of an initial event etc.

[0055] At the decision step S16 following ON/OFF setting out of each heater of S31-S36, an infanticide counter value is investigated and that it is the break (the last half wave) of 3 half-wave length periods, i.e., an infanticide counter value, investigates whether it is 2. If it is not the location of such a break, the return of the temperature sample F will be reset and (S39) carried out.

[0056] It thins out at the decision step S16, and when a counter is 2 (i.e., when it comes to the break (the last half wave) of 3 half-wave length periods), a continuation counter investigates whether it is under [ count ] \*\*\*\*\* at the following decision step S17. During a count of a continuation counter, what the continuation counter started by either of previous steps S23, S25, and S27 is meant. A continuation counter will be incremented if it is under count (S38). This continuation counter is set up in order to maintain an energization condition beyond fixed time amount (multiple of 3 half-wave length periods) compulsorily, as mentioned above. If this continuation counter has not reached a predetermined value (S18, No), it shifts to a juncture (g). Here, the temperature sample F is reset (S39). Therefore, in the following interruption cycle, a temperature sample is not made, but will be thinned out and the wave number infanticide energization based on a counter value will be maintained succeeding. Thus, the minimum duration time of an energization condition is managed with the continuation counter.

[0057] A continuation counter is stopped when the continuation counter has reached the predetermined value in S18 (S40). Moreover, it directs to perform a temperature sample at the beginning of (S41) and the following interruption routine, and to switch an energization condition according to a temperature sample by setting the temperature sample F.

[0058] The sample of the temperature T will be carried out (S19), it will shift to the Y side at step S1 at the beginning of the following interruption routine

after the temperature sample F was set at step S41 ( drawing 9 ), and the temperature T will be investigated. For example, if temperature is in  $T_a > T_b$ , it will flow to the Y side of the decision step S3, and will judge whether the energization status flag before set at step S6 is the same as the energization status flags 1/3F to be set from now on. not starting a continuation counter and having made it stop freely, when the same -- carrying out -- said -- only 1/3F are set (S24), and it is made to shift to the next juncture (d) Henceforth, since 2 half-wave infanticide was made between 3 half-wave-length periods and Y side) and a continuation counter have already stopped by the break of 3 half-wave length periods (S16, processing shift is carried out by S17 at the N side, and temperature Sun Bull F is set again (S41).

[0059] If it flowed to the Y side at the decision step S1 similarly at the time of the next interruption routine initiation, for example, temperature passed decision step S4 by  $T_b > T_c$ , it considers that it has a switch of an energization condition at the decision step S7 since the last energization condition F was 1/3F, processing shift is carried out to the N side, and a continuation counter is started (S25), and 2/3F are set (S26). This 2/3 energization would be directed to the continuation counter at least, and will carry out time amount continuation.

[0060] In the decision step S2, the last flag is not investigated by the Y side, there are no start directions of a continuation counter, and the minimum duration time of the energization F (0/3F) set here is not specified. That is, with the gestalt of this operation, continuation exceeding 3 half-wave length periods is not intentionally directed to 0 / 3 energization condition. Since full putting out lights of a fixing heater of continuing from a viewpoint of fixable [ to a form ] is not desirable, compulsory continuity is made into the condition that there dares be nothing.

[0061] The following matters are mentioned as a merit of the gestalt of this operation of 3 half-wave length criteria expressed above.

[0062] (1) The energization which does not have infanticide of a half wave by making into a period a part for the 3 half-wave lengths which supply voltage follows (3/3), Four steps of energization patterns [ having the energization which thins out one half wave by making the 3 half-wave lengths into a period (2/3), the energization which thins out two half waves (1/3), and no energization (0/3) ] by 4 value control matched with the quadrisection range of the temperature for heating of a heater, respectively Compared with the conventional binary control, the temperature control of finer high degree of accuracy can be attained.

[0063] Simultaneously, in a continuous temperature control, since change (difference) of an energization condition is always a part for a half wave per 1/3 (refer to drawing 8 ), 1 [ i.e., ], period, a rapid current change of heater

energization can be reduced effectively.

[0064] (2) Moreover, control hardware is comparatively simple. For example, in the case of a phase control method which was mentioned above, it is necessary to generate the pulse which specifies the phase angle which should set up a timer from the zero crossing point of supply voltage, and should turn on a heater. These must prepare hardware, such as the complexity of the control [ itself ], and a timer style. On the other hand, if it is "wave number control", since it is only turning on a heater on a zero cross origin, the timer which determines a phase becomes unnecessary. Moreover, the complexity on control, such as those setting out and starting, decreases that much.

[0065] (3) Further, since the heater current in "wave number control" is impressed from a zero cross origin, it does not almost have a high order frequency current change of the power line period on a power-source line, and generating of the so-called power-source higher harmonic. Usually, such a problem is solved by the gestalt of this operation, although the mass inductance (choke coil) was inserted in the heater and the serial and it had become a failure over miniaturization of the machine by reservation of cost lifting by addition of an excessive electrical part, and its installation, in order to suppress generating of such a power-source higher harmonic wave.

[0066] As mentioned above, although the gestalt of suitable operation of this invention was explained, various deformation and modification are possible.

---

[Translation done.]

\* NOTICES \*

JPO and NCIP are not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.\*\*\* shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

4 Heater

5 Thermistor Temperature Sensor

---

[Translation done.]

---

DESCRIPTION OF DRAWINGS

---

[Brief Description of the Drawings]

[Drawing 1] It is the schematic diagram of the fixing roller as a target example with which this invention is applied.

[Drawing 2] It is drawing showing the heater energization current wave form at the time of the conventional ON/OFF temperature control for the temperature control of the heater roller of drawing 1 .

[Drawing 3] It is the explanatory view of energization of HITAKE by the conventional phase control (conduction angle control).

[Drawing 4] It is the explanatory view of generating of fluctuation of the supply voltage resulting from device current variation.

[Drawing 5] the wave of the energization condition (b) of the different number of infanticide from four temperature requirements (a) in the gestalt of operation of this invention, and a different energization condition -- it is drawing showing (c).

[Drawing 6] It is the explanatory view of the energization pattern which made 3 half-wave length periods the set by two periods, and made six half waves one new period in the gestalt of other operations of this invention.

[Drawing 7] It is the circuit diagram of the control circuit for realizing wave number control of the gestalt of operation of this invention.

[Drawing 8] It is the wave form chart showing an example of the actual temperature control (temperature control) condition under standby with the gestalt of operation of this invention, and print (copy).

[Drawing 9] It is the flow chart which shows the software procedure for realizing wave number control in the gestalt of operation of this invention.

[Drawing 10] It is a flow chart following drawing 9 .

[Description of Notations]

1 Heater Roller

2 Application-of-Pressure Roller

3 Form